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VOLUME XIX.

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THE PENNY CYCLOPÆDIA

OF

THE SOCIETY FOR THE DIFFUSION OF USEFUL KNOWLEDGE.

PRIMATICCIO, FRANCESCO, was born at Bologna, in 1490. He was of a noble family, and his parents intended to have him brought up to the mercantile profession; but his natural genius leading him to the arts, he learned design and colouring from Innocenzio da Imola and Bagnacavallo, and having manifested extraordinary talent, he went to Mantua to study under Julio Romano, who was engaged on some great works in the palace Del Tè at Mantua, many of which Primaticcio and others of his disciples executed after his designs. Frederic, duke of Mantua, recommended him in 1531 to Francis, king of France, who entrusted him with many works. A great jealousy arising between him and Rosso, who was likewise in high favour with Francis, the king sent Primaticcio to Rome to purchase antiques, a commission in which he was extremely successful. He was recalled from Rome to complete a large gallery left unfinished by the death of Rosso. The number of works which he executed in France is truly astonishing, especially in the palace of Fontainebleau, where, assisted by his pupil Nicolo Abate, he painted, besides other works, in the great gallery, which was 456 feet long and 18 wide, fifty-eight pictures, each 6½ feet high and 8 feet wide, representing the principal scenes of the Odyssey; the roof, which was richly adorned with gilding and stucco, was decorated with fifteen large and sixty small pictures, chiefly subjects of heathen mythology. This great work was totally destroyed in 1738, when the great gallery was pulled down to erect apartments for some persons attached to the court. Francis II. gave him the abbey of St. Martin de Troyes, with a revenue of 8000 crowns, which he enjoyed till his death in 1570. Primaticcio's talents however were chiefly called into exercise under Henry II., most of the frescoes with which Francis intended to adorn Fontainebleau not being executed till after his death. The oil-paintings of Primaticcio are excessively rare in Italy. Fuseli mentions a Concert of three female figures in the Zambeccari gallery as an enchanting performance; and Dr. Waagen says that a picture at Castle Howard representing Penelope relating to Ulysses what has passed in his absence, is the finest work of this master that he had yet seen.

PRIME. A number is said to be prime when it is not divisible without remainder by any less number than itself, except unity. Thus 1, 2, 3, are of necessity prime; 4 is not, being divisible by 2; 5 is prime, and so are 7, 11, 13, 17, 19, 23, 29, 31, &c.

Large lists of prime numbers have been published [TABLES], but they are seldom possessed by the elementary student. As it is however frequently desirable to know whether a number not exceeding 10,000 is prime or not, we shall give a table to that extent, the manner of using which is as follows:—If we wish to know whether 2897 be a prime number, under the heading 2 and in the column 8 we look for 97, which we find there: whence the table shows that 2897 is a prime number. Again, by the same means we find that 1457 is not a prime number, the adjacent prime numbers being 1453 and 1459.

0

0	1	2	3	4	5	6	7	8	9
1	01	11	07	01	03	01	01	09	07
2	03	23	11	09	09	07	09	11	11
3	07	27	13	19	21	13	19	21	19
5	09	29	17	21	23	17	27	23	29
7	13	33	31	31	41	19	33	27	37
11	27	39	37	33	47	31	39	29	41
13	31	41	47	39	57	41	43	39	47
17	37	51	49	43	63	43	51	53	53
19	39	57	53	49	69	47	57	57	67
23	49	63	59	57	71	53	61	59	71
29	51	69	67	61	77	59	69	63	77
31	57	71	73	63	87	61	73	77	83
37	63	77	79	67	93	73	87	81	91
41	67	81	83	79	99	77	97	83	97
43	73	83	89	87		83		87	
47	79	93	97	91		91			
53	81			99					
59	91								
61	93								
67	97								
71	99								
73									
79									
83									
89									
97									

0	1	2	3	4	5	6	7	8	9
09	03	01	01	09	11	01	09	01	01
13	09	13	03	23	23	07	21	11	07
19	17	17	07	27	31	09	23	23	13
21	23	23	19	29	43	13	33	31	31
31	29	29	21	33	49	19	41	47	33
33	51	31	27	39	53	21	47	61	49
39	53	37	61	47	59	27	53	67	51
49	63	49	67	51	67	37	59	71	73
51	71	59	73	53	71	57	77	73	79
61	81	77	81	59	79	63	83	77	87
63	87	79	99	71	83	67	87	79	93
69	93	83		81	97	69	89	89	97
87		89		83		93			99
91		91		87		97			
93		97		89		99			
97				93					
				99					

2

0	1	2	3	4	5	6	7	8	9
03	11	03	09	11	03	09	07	01	03
11	13	07	11	17	21	17	11	03	09
17	29	13	33	23	31	21	13	19	17
27	31	21	39	37	39	33	19	33	27
29	37	37	41	41	43	47	29	37	39
39	41	39	47	47	49	57	31	43	53
53	43	43	51	59	51	59	41	51	57
63	53	51	57	67	57	63	49	57	63
69	61	67	71	73	79	71	53	61	69
81	79	69	77	77	91	77	67	79	71
83		73	81		93	83	77	87	99
87		81	83			87	89	97	
89		87	89			89	91		
99		93	93			93	97		
		97	99			99			

3

0	1	2	3	4	5	6	7	8	9
01	09	03	01	07	11	07	01	03	07
11	19	09	07	13	17	13	09	21	11
19	21	17	13	33	27	17	19	23	17
23	37	21	19	49	29	23	27	33	19
37	63	29	23	57	33	31	33	47	23
41	67	51	29	61	39	37	39	51	29
49	69	53	31	63	41	43	61	53	31
61	81	57	43	67	47	59	67	63	43
67	87	59	47	69	57	71	69	77	47
79	91	71	59	91	59	73	79	81	67
83		99	61	99	71	77	93	89	89
89			71		81	91	97		
			73		83	97			
			89		93				
			91						

4

0	1	2	3	4	5	6	7	8	9
01	11	01	27	09	07	03	03	01	03
03	27	11	37	21	13	21	21	13	09
07	29	17	39	23	17	37	23	17	19
13	33	19	49	41	19	39	29	31	31
19	39	29	57	47	23	43	33	61	33
21	53	31	63	51	47	49	51	71	37
27	57	41	73	57	49	51	59	77	43
49	59	43	91	63	61	57	83	89	51
51	77	53	97	81	67	63	87		57
57		59		83	83	73	89		67
73		61		93	91	79	93		69
79		71			97	91	99		73
91		73							87
93		83							93
99		89							99
		97							

5

0	1	2	3	4	5	6	7	8	9
03	01	09	03	07	01	23	01	01	03
09	07	27	09	13	03	39	11	07	23
11	13	31	23	17	07	41	17	13	27
21	19	33	33	19	19	47	37	21	39
23	47	37	47	31	21	51	41	27	53
39	53	61	51	37	27	53	43	39	81
51	67	73	81	41	31	57	49	43	87
59	71	79	87	43	57	59	79	49	
77	79	81	93	49	63	69	83	51	
81	89	97	99	71	69	83	91	57	
87	97			77	73	89		61	
99				79	81	93		67	
				83	91			69	
								79	
								81	
								97	

0	1	2	3	4	5	6	7	8	9
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	21	07	01	03	07
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	29	19	03	23	11
[illegible]	[illegible]	[illegible]	[illegible]	49	47	37	09	27	17
[illegible]	[illegible]	[illegible]	[illegible]	51	51	53	19	29	47
43	33	29	29	69	53	59	33	33	49
47	43	47	37	73	63	61	37	41	59
53	51	57	43	81	69	73	61	57	61
67	63	63	53	91	71	79	63	63	67
73	73	69	59		77	89	79	69	71
79	97	71	61		81	91	81	71	77
89	99	77	67		99		91	83	83
91		87	73				93	99	91
		99	79						97
			89						
			97						

0	1	2	3	4	5	6	7	8	9
01	03	07	07	11	07	03	03	17	01
13	09	11	09	17	17	07	17	23	07
19	21	13	21	33	23	21	23	29	19
27	27	19	31	51	29	39	27	41	27
39	29	29	33	57	37	43	41	53	33
43	51	37	49	59	41	49	53	67	37
57	59	43	51	77	47	69	57	73	49
69	77	47	69	81	49	73	59	77	51
79	87	53	93	87	59	81	89	79	63
	93	83		89	61	87	93	93	93
		97		99	73	91			
					77	99			
					83				
					89				
					91				

8

0	1	2	3	4	5	6	7	8	9
09	01	09	11	19	01	09	07	03	23
11	11	19	17	23	13	23	13	07	29
17	17	21	29	29	21	27	19	19	33
39	23	31	53	31	27	29	31	21	41
53	47	33	63	43	37	41	37	31	51
59	61	37	69	47	39	47	41	37	63
69	67	43	77	61	43	63	47	39	69
81	71	63	87	67	63	69	53	49	71
87	79	69	89		73	77	61	61	99
89	91	73			81	81	79	63	
93		87			97	89	83	67	
		91			99	93		87	
		93				99		93	
		97							

9

0	1	2	3	4	5	6	7	8	9
01	03	03	11	03	11	01	19	03	01
07	09	09	19	13	21	13	21	11	07
11	27	21	23	19	33	19	33	17	23
13	33	27	37	21	39	23	39	29	29
29	37	39	41	31	47	29	43	33	31
41	51	41	43	33	51	31	49	39	41
43	57	57	49	37	87	43	67	51	49
49	61	77	71	39		49	69	57	67
59	73	81	77	61		61	81	59	73
67	81	83	91	63		77	87	71	
91	87	93	97	67		79	91	83	
	99			73		89		87	
				79		97			
				91					
				97					

The distribution of the prime numbers does not follow any discoverable law, but it begins to be evident from the preceding table, that in a given interval the number of primes is generally less, the higher the beginning of the interval is taken. The following table will set this in a clearer light: the numbers in the first column mean thousands, and in the second column are found the numbers of primes which lie in the interval specified in the first column. Thus between 10 thousand and 20 thousand lie 1033 primes.

Between	No. of Primes.	Between	No. of Primes.
0 and 10	1230	150 and 200	4135
10 and 20	1033	200 and 250	4061
20 and 30	983	250 and 300	3943
30 and 40	958	300 and 350	3989
40 and 50	930	350 and 400	3884
50 and 60	924	400 and 500	7677
60 and 70	878	500 and 600	7555
70 and 80	901	600 and 700	7442
80 and 90	876	700 and 800	7402
90 and 100	879	800 and 900	7331
100 and 150	4257	900 and 1000	7225

In the first 10,000 numbers, upwards of 12 per cent. are primes; but between 900 thousand and a million, only 7½ per cent. are primes. The preceding enumerations are taken from Legendre's Theory of Numbers, and were made from the large tables of primes given by Vega, Chernac, and Burkhardt. The only thing known relative to the proportions of prime numbers to others is that if x be a very large number, the number of primes contained between 0 and x is nearly $x \div (\log x - 1{\cdot}08366)$, $\log x$ being the Naperean logarithm. This very curious theorem was discovered empirically, that is, by looking for a formula which should nearly represent the results of tables. Legendre, in the work cited, gave proof that such a formula must have the form $x \div (A \log x - B)$, but no reason has yet been given why A is 1, and B is 1·08366. Using the common logarithm, we find that the number of primes less than x is such a proportion of x as ·4342945 is of $\log x$ — ·470628, nearly. Thus, of all numbers less than a million of million of millions, only one out of 40 is prime, while the number of primes under the square of that number is one out of 82.

It thus appears that we might name a succession of numbers beginning with one so high, that a million, or any other number however great, of numbers should pass without containing one prime number. Nevertheless there cannot be an end to the prime numbers; for if so, let p be the last prime number, and let N be the product of all the prime numbers 2, 3, 5, ..., p. Now every number is either prime or divisible by a prime; but $N + 1$ is not divisible by 2, 3, 5, ... or p, since it leaves a remainder 1 in every such division. It is therefore prime, or there is a prime number $N + 1$, greater than the greatest prime number p, which is absurd. The following are among the properties of prime numbers. (1.) Every prime number (except 2) is odd, or of the form $2x + 1$. (2.) Every prime is of the form $4x + 1$ or $4x + 3$, and a prime of the form $4x + 1$ is always the sum of two squares. (3.) Every prime is of the form $6x + 1$ or $6x + 5$. (4.) No algebraical formula can always represent a prime number; but some formulæ show a long succession of primes: thus $x^2 + x + 41$ is prime from $x = 0$ to $x = 39$, both inclusive. (5.) If $2x + 1$ be a prime number, and N any number which it does not divide, either $N^x - 1$ or $N^x + 1$ must be divisible by $2x + 1$. (6.) If M and N be two prime numbers, and if $M = 2x + 1$, $N = 2y + 1$, then if x and y be both odd numbers, either $(M^y - 1) : N$ and $(N^x - 1) : M$ are both whole numbers, or $(M^y + 1) : N$ and $(N^x + 1) : M$ are both whole numbers. But if x and y be not both odd, then either $(M^y - 1) : N$ and $(N^x + 1) : M$ are both whole numbers, or else $(M^y + 1) : N$ and $(N^x - 1) : M$ are both whole numbers. This theorem is of considerable importance in the theory of numbers, and has been termed the law of reciprocity of prime numbers.

Two numbers are said to be prime to one another, when they have not any common measure except unity: as 36 and 55.

The prime factors of a number are those prime numbers which divide it. Thus 360 being $2^3 \times 3^2 \times 5$, its prime factors are 2, 3, 5, of which the first enters three times, the second twice, and the third once. If A, B, C, ... be the prime factors of a number, and a, b, c, ... the number of times which they severally enter, the number is $A^a \times B^b \times C^c \times$ ....., and the number of divisors which it admits of (unity and itself included) is $(a+1) \times (b+1) \times (c+1) \times$ ..... Call this number N: then the number of numbers less than N, and prime to N, is

$$N \times \frac{a-1}{a} \times \frac{b-1}{b} \times \frac{c-1}{c} \times \ldots\ldots$$

PRIME AND ULTIMATE RATIOS. [Ratios, Prime and Ultimate; Differential Calculus.]

PRIME'RO, a game at cards, so called from a situation in the game. He who holds the *prime* (primero), that is, a sequence of the best cards and a good trump, is sure to be successful over his adversaries; hence its denomination *Primero*, *Prime*, and *Primavista* were one and the same game.

Primero appears to have been one of the earliest games at cards played in England, and continued to be the most fashionable game throughout the reigns of Henry VIII., Edward VI., Mary, Elizabeth, and James. In the earl of Northumberland's letters relating to the powder-plot, we find that Josceline Percy was playing at primero on Sunday, when his uncle, the conspirator, called on him at Essex-house. In the Sydney Papers there is an account of a quarrel between Lord Southampton, the patron of Shakspere, and one Ambrose Willoughby, on account of the former persisting to play at primero with Sir Walter Raleigh and another, in the Presence Chamber, after the queen had retired to rest.

Shakspere speaks of Henry VIII. playing at primero with the duke of Suffolk.

One of the dialogues at the end of Minshew's Spanish Dictionary illustrates the method of playing this game; many of the terms of which are also detailed in one of Sir John Harington's epigrams, in which he describes 'the Story of Marcus's Life at Primero.'

It is uncertain whether this game is of Spanish or Italian origin. Daines Barrington and Mr. Bowle (*Archæologia*, vol. viii., 133-151) were of opinion that it is of Spanish origin; but Berni's *Capitolo del Gioco della Primeira* affords proof that it was at least commonly played in Italy at the commencement of the sixteenth century.

(Nares's *Glossary*; Singer's *Researches into the History of Playing Cards*, 4to., Lond., 1816, p. 244-256.)

PRI'MNOA, a subdivision of the Linnæan genus Gorgonia.

PRIMOGENITURE may be defined to be that rule of law by which a title of dignity or an estate in land comes to a person in respect of his being an eldest male. If a man dies seised of real estate, of which he had the absolute ownership, without having made any disposition of it by his last will, the whole descends to the heir at law or customary heir; and the heir at law is such by virtue of being the eldest male person of those who are in the same degree of kindred to the person dying, or the representative of such eldest male. [DESCENT.] This is a case in which primogeniture operates. A common example of primogeniture is where a father dies absolutely entitled to real estate, and without disposing of it by will, in which case his eldest son takes it all. If land is settled or entailed on a man and his male issue, the eldest son takes the land by two titles, first as being a male, and next as being the eldest son. The law of primogeniture then only applies in the case of land when the owner dies without having made any disposition of it by will, or where the land is settled on a man and his male issue. It does not apply when the interest in land is a chattel interest, or a term of years, whatever may be its duration.

At present, those who are the absolute owners of large landed estates seldom die without making a disposition of them by will. In the case of lands which are settled, the person in possession is generally tenant for life, and the inheritance is entailed on the eldest son. When the eldest son is about to marry, it is usual for the father and son to take the usual legal steps (which they can do as soon as the son is of age) to unsettle the estate and obtain the absolute ownership. They then resettle the estate, making the father tenant for life as before; the son, who was before tenant in tail, is also made only a tenant for life; and the inheritance is settled, as before, on the eldest son of the intended marriage. Such eldest son takes the estate, not as heir, and therefore not by the law of primogeniture, but he takes it as the person designated by the deed of settlement.

When a man happens to be tenant in tail, he usually takes the legal steps necessary (which he can do as soon as he is of age) to acquire the absolute ownership of the property, which he then generally settles again by deed or will, or disposes of absolutely.

It is usual in England to settle all large estates, and the object of the settlement is to keep the estates together, and to perpetuate them in one family; but there is a limit to this power of settlement. A man cannot, either by deed or will, settle his land, so as to prevent the absolute ownership of it from being obtained, for a longer period than a life or lives of persons in existence at the time when the settlement takes effect, and twenty-one years more.

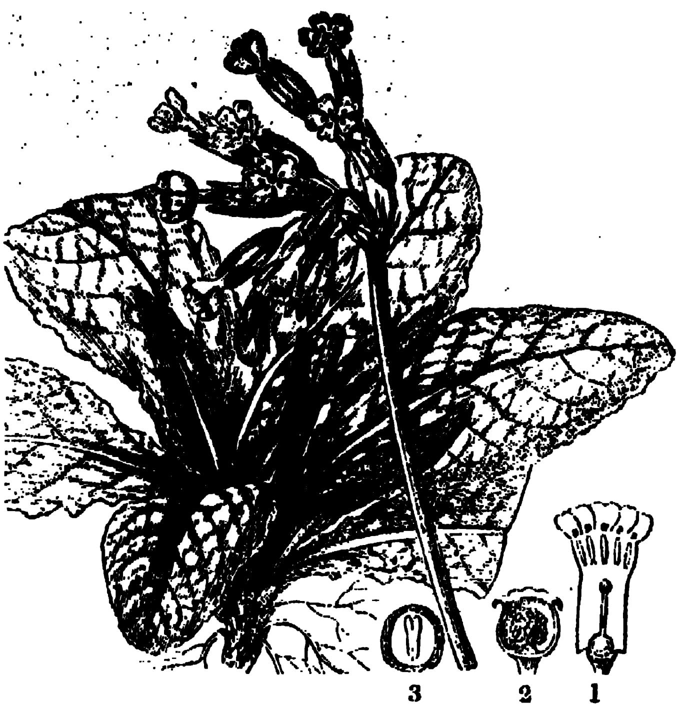
Lands in GAVELKIND and BOROUGH ENGLISH are an exception to the general rule of law as to the descent of land.

The law of primogeniture then only operates in the cases already explained; and the system of settlements by which property is kept together in large masses is quite distinct in principle from the law of primogeniture. It is not the result of a law which favours primogeniture, but it is the result of the legal power which an owner of land has over it, and of the habits of the people. The various reasons which have laid the foundation of this habit, and which perpetuate it, are foreign to the consideration of primogeniture as a rule of law.

In Virginia, after the Revolution, an act was passed for converting estates tail into fee-simple, and at the same time the law of primogeniture was abolished. These laws have so far been in accordance with or have acted on public opinion, that a parent by his will now generally makes the same disposition of his property as the law makes in case he dies intestate. (Tucker's *Life of Jefferson*, i. 96, &c.)

(*Remarks on Primogeniture and Entails*, Hayes, *Introduction to Conveyancing*.)

PRIMULA'CEÆ are monopetalous Exogenous plants, peculiarly distinguished by the stamens being opposite to the lobes of the corolla, and a superior capsule with a free central placenta. In most respects they correspond indeed with the Myrsinaceous order, but the latter are known by their being trees or shrubs with an indehiscent fleshy fruit. The Primulaceous order consists of herbaceous plants inhabiting the temperate parts of the world, in moist situations, such as meadows, morasses, and alpine stations, or in the damp parts of woods, which they adorn with their lively flowers. The Primula, Anagallis, Soldanella, Cyclamen, and Lysimachia, of various species and under many forms, are the gayest of the genera, some of whose species are found in almost all gardens. The cowslip is slightly narcotic, but the order is of no known utility.



Primula veris

1, a corolla laid open; 2, a section of a capsule; 3, a section of a seed.

PRIMUM MO'BILE, the name given in the old astronomy to the imaginary sphere by the motion of which diurnal motion was given to the heavens. [PTOLEMAIC SYSTEM.]

PRINCE is the Latin word *princeps*, which was originally used to denote the person who was entitled princeps senatus in the Roman State. He seems to have been originally the custos of the city, and his office was one of importance. Subsequently it became a title of dignity, and the princeps was named by the censors. (Liv., xxvii. 2.) In the senate he gave his opinion first after the magistratus. Augustus and his successors adopted the title of princeps, as a name that carried no odium with it: and this became henceforward the characteristic title of the master of the Roman world. Accordingly the constitutions of the emperors are called principum (Gaius, i. 2). or principales. The word princeps is formed similarly to anceps, municeps, &c., and contains the same element as 'primus.' In the course of time the word prince, which is derived from princeps, has come to be applied to persons having personal preeminence, and especially to certain sovereigns of smaller states possessing either perfect independence of all others or enjoying under some superior high political rights. Of the first kind were the old sovereigns of Wales, who, under the name of princes, enjoyed the same right and power which belong to kings: and of the second, the heads of certain states of Germany comprehended in the great Germanic confederation. But the word seems not to have acquired so definite a sense as that which belongs to king, duke, marquis, earl, and some others of the class; but rather to denote persons of eminent rank in certain states, as in Prussia, Russia, Italy, and other continental states, when no sovereignty, properly so called, comes along with it, or persons who are junior members of sovereign houses, as Prince Leopold, Prince Albert, both younger members of one branch of the sovereign house of Saxe.

In England it has sometimes been the practice of the heralds to speak of a duke as the high and mighty prince; but the word seems rather to be restricted among us in its application to persons who are of the blood-royal, that is, a son, grandson, or nephew of a king; and it would probably be extended to the remote male posterity, though no such case has arisen in the course of the last three centuries; and in its application it is merely a term of common parlance, not being conferred, like the title of duke, in any formal manner; and even the precedence which is given to blood-royal has respect to birth, and not to the enjoyment of this word as a title of honour. The king's eldest son is however made Prince of Wales by a special act of creation.

PRINCE EDWARD'S ISLAND, a British island on the coast of North America, in the Gulf of St. Lawrence, is situated between 45° 58′ and 47° 7′ N. lat. and between 62° and 64° 27′ W. long. It extends from east to west in a somewhat curved line 135 miles in length. The width varies between 34 miles and one mile. The surface is calculated to comprehend an area of 2157 square miles, or 1,380,480 acres: it is about 45 square miles larger than the North Riding of Yorkshire. It is separated from Nova Scotia and New Brunswick by Northumberland Strait, which in the narrowest part is hardly more than ten miles wide.

The coast is so intersected by bays and creeks, that there is hardly a place which is more than eight miles from the shore. These bays and inlets form good harbours, and the larger ones contain several branches which have good anchorage. Only at the western extremity, between North Cape and West Cape, and again along the northern coast towards the eastern extremity, between St. Peter's Bay and East Cape, there is no harbour. The most remarkable of these bays is Hillsboro Bay, which enters the island from the south with a broad opening, but afterwards becomes so narrow that it appears like a river, and is accordingly called Hillsboro River: the tide ascends nearly to its extremity, 20 miles above Charlotte Town. Farther west are Halifax Bay and Richmond Bay, of which the former intersects the country from the south and the latter from the north, so as to leave between them only an isthmus one mile wide. Richmond Bay stretches ten miles from its entrance inland, and is nine miles wide, but the entrance is contracted by a long narrow island lying across it.

The surface of the island consists of gentle ascents and descents. There is no plain of any extent, and the eminences do not deserve the name of hills, with the exception perhaps of a series of heights which intersect the island nearly in the middle, running from Disable Bay on the southern shores, to Grenville Bay on the north. The soil, though nowhere very fertile, is in general productive. There are a few swamps, some of which are dry and covered with shrubs and moss; others are wet, and produce dwarf alder, long grass, and a variety of shrubs. There are also barren tracts which produce nothing except dry moss or shrubs. But the swamps and barrens bear only a small proportion to the whole surface of the island.

The climate of Prince Edward's Island is favourably distinguished from that of all the surrounding countries by being exempted from fogs and being much less subject to cold. A misty fog appears sometimes on a summer or autumnal morning, but it is soon dispersed. The winter is two months shorter than in Nova Scotia and New Brunswick, and the frost much less intense; snow however falls in considerable quantity. For three or four months the country is covered with it. In April spring begins, but the heat increases rapidly, and summer may be considered as beginning in May. In June, July, and August the heat is excessive, the thermometer commonly rising to 80° or 90° and during this period thunder-storms are frequent. From September to November the season is pleasant, and in December the frost sets in.

With the exception of the swamps and barrens, the island was formerly entirely overgrown with high forest-trees, especially pine, the timber of which has been so largely exported to England, that at present there is no more than is required by the inhabitants for house and ship building and other purposes. The other trees are spruce-fir, hemlock, beech, birch, maple, poplar, and white cedar in abundance; oak, elm, ash, and larch are not plentiful, and the quality of the first is very inferior. At present about one half of the cultivable surface of the island is still wooded.

Soil and climate unite to make this island an agricultural country. All kinds of grain and vegetables raised in England grow very well. Wheat, barley, and oats are extensively grown; and some winter-rye and buckwheat. Beans and peas are also raised. All the culinary vegetables common in England attain perfection. Indian-corn does not succeed well. Flax is raised only for home consumption, and is of excellent quality; hemp does not thrive well. The fruits are cherries, plums, damsons, and black, red, and white currants. Apples and pears require great attention, and are of inferior quality.

The horses are small but hardy. The black cattle are of a smaller size than in England. Sheep and swine are plentiful, and the breed of the former has lately been much improved. The wild animals are bears, loup-cerviers, foxes, hares, otters, martens, musquashes, minks, squirrels, musk-rats, and weasels. The bears, which formerly destroyed a great number of cattle, sheep, and hogs, have been nearly exterminated. Otters, martens, and musk-rats, which supply valuable furs, have become scarce. Seals are found in bays and along the shores in summer and autumn; and summer immense numbers sometimes come down on the from the northward. Among the birds, the partridges distinguished by their size, and wild pigeons are numer but only appear in summer. Wild geese make a sta about six weeks in spring, and about as long in autu Fish as well as shell-fish are plentiful, and the oysters considered the finest in America. Many cargoes are annu sent to Quebec and Halifax.

No minerals have been found on the island except and white clay, fit for bricks and pottery.

The island is divided into three counties, King's Cou Queen's County, and Prince's County. Queen's Cou occupies the central districts, King's County the east, Prince's County comprehends the west. Queen's Cou contains 771 square miles, and is nearly equal to Nott hamshire; King's County contains 650 square miles, ar not so large as Worcestershire; Prince's County has square miles, or almost as many as Oxfordshire. The po lation chiefly consists of Scotch emigrants and their scendants, some families of English extraction, and a Acadians, or Americans of French origin. Formerly t were several families of Micmac Indians, but it appears they have all emigrated to Chaleurs Bay. In 1768 the n ber of families did not exceed 150. According to the ce taken in 1827, the population consisted of about 36, and as the number of settlements was then rapidly creasing, Bouchette estimated the population, in 1832 50,000.

The settlements are dispersed all over the island. coasts are more densely settled than the interior, with exception of the western coast between North Cape East Cape, which is almost entirely in its natural state, is overgrown with forests. The northern coast has a gre number of settlements than the southern. Charlotte To the capital and seat of government, is situated in Que County, on the north side of Hillsboro River, near its fluence with the rivers Elliot and York. The harbou considered one of the best in the Gulf of St. Lawrence. the entrance it is little more than half a mile wide, within it enlarges and forms a safe and spacious basin, wi branches off into three beautiful and navigable rivers. town stands on a gently rising ground, and is regu built with broad streets intersecting each other at r angles. There is a court-house, an Episcopal churc Scotch church, and a Roman Catholic and a Metho chapel. In 1830 it contained about 350 dwelling-ho and 3400 inhabitants. In three or four places on the eas and northern coast timber is shipped for England.

Ship-building is carried on in this island, and a consi able number of vessels, from one hundred to six hun tons, are built for the British market: but the prim trade of the island consists in supplying Newfoundland schooners for the seal and cod fisheries, with black ca sheep, hogs, poultry, oats, potatoes, turnips, &c.; the ret are chiefly made in money or West India produce. W and other grain are sent to Miramichi and other settlem on the eastern coast of New Brunswick, where the pop tion are chiefly engaged in preparing timber for the ma The same articles are sent to Halifax. Beef, pork, sh hams, cheese, oats, potatoes, flour, and fish are occasio exported to Bermuda. Though the best fishing-ba within the Gulf of St. Lawrence lie in the immediate nity of the northern shores of this island, fishing is not ried on to any great extent.

Prince Edward's Island was discovered by Cabot in 1 on St. John's day, and hence it obtained the name of John's Island, which it preserved up to 1799, when it changed into its present name in honour of the late duk Kent. It was taken possession of by the French after settlement of Canada, but no permanent establishe seems to have been formed in it before the peace of Utr (1713), when some families from Cape Breton settled th In 1758 it was taken by the English, who retained pos sion of it at the peace of Paris (1763). In 1770 a sepa constitution was granted to it, and the first House of sembly met in 1773.

Prince Edward's Island is in the diocese of Nova Sc There are two schools supported by the governmen Charlotte Town; and there are also schools for ele tary instruction in most of the settlements. The gov ment is conducted by a lieutenant-governor and a cou which also acts in a legislative capacity; and there is a House of Assembly, which consists of eighteen members. The English law is administered by a chief-justice, and there are district courts for the recovery of small debts.

(MacGregor's *British America*; Bouchette's *British Dominions in North America*.)

PRINCE WILLIAM'S SOUND is a wide bay on the north-west coast of North America, extending, with several branches, between 60° and 61° N. lat. and between 146° and 148° 30′ W. long. It is called by the Russians Tshougathkaia. It opens to the south, and the entrance contains two large islands, of which the eastern is called Rose Island, and the western Montague Island. In both islands there are good harbours, and the largest vessels may enter the bay on both sides of Montague Island. Rose Island contains Port Etches, where the Russians have a factory, and a wooden fort, called Fort Constantine. The islands are rocky and mountainous, but the mountains do not rise so high as on the continent. The country abounds in pine-trees, some of which are very large; there is also a great quantity of alder and hazel trees. Wild berries, as strawberries, raspberries, and alderberries, are plentiful. Sea-otters and foxes are still frequently met with, and other fur-bearing animals are abundant in the forests. The natives, who are few in number, and called Oogaliakhmutes, live mostly on the produce of their fishing. They are short in stature, and seem to be a cross between the Esquimaux and the other Indians. (Portlock's *Voyage Round the World*.)

PRINCE OF WALES'S ISLAND. [PENANG.]

PRINCE'S METAL, or *Prince Rupert's Metal*, an alloy of copper and zinc, which contains more copper than brass does, and is prepared by adding this metal to the alloy.

PRINCIPAL, the name of a stop or row of metal pipes in an organ, tuned an octave higher than the diapason, an octave lower than the fifteenth, and serving to blend the two, as well as to augment the volume of sound.

PRINCIPAL. [AGENT.]

PRINCIPA'TO CITRA. [SALERNO, Province.]

PRINCIPA'TO ULTRA, called also 'Provincia di Avellino,' is a province of the kingdom of Naples, bounded on the north by the provinces of Sannio and Capitanata, from which it is divided [illegible] central ridge of the Apennines, on the east by Capita[illegible] on the south by Basilicata and the province of Salerno, and on the west by Terra di Lavoro. The province of Principato Ultra lies almost entirely in the Apennines, and between the western lower ridge of those mountains, including Monte Taburno, Tifata, and Monteforte, which divides the basin of the river Calore, an affluent of the Volturno, from the plains of Campania, and the central ridge, which forms the watershed between the streams that flow into the Mediterranean and into the Adriatic. The Calore and its affluents the Tamaro and Sabbato are the principal rivers of the province. A small part of Principato Ultra however extends along the eastern slope of the central ridge, where the river Ofanto (Aufidus) has its source in the neighbourhood of Conza and Nusca.

Owing to the local situation of the province and its elevation above the sea, the temperature is considerably lower upon the whole than that of the plains of Campania, although in some of the valleys the summer heats are occasionally very great. Some places in the valley of the Calore are subject to the malaria in consequence of stagnant waters. The country produces corn, fruits in abundance, silk, some wine, and has excellent pasture for cattle. By the last census the population of the whole province was 390,000, exclusive of Benevento and its territory, which belongs to the pope, although geographically included within the boundaries of Principato Ultra. [BENEVENTO.] The area is reckoned at 1960 square miles. (Neigebaur; Serristori.) The principal towns of the province are, Avellino, Ariano, Montesarchio with 6000 inhabitants, Montefusco, with 3000, and Sant' Angelo dei Lombardi. The province is divided, for administrative purposes, into three districts:—Avellino, Ariano, and Montefusco.

The province of Principato Ultra occupies the country of the antient Hirpini, one of the nations of the Samnite confederation.

PRINCI'PIA, the contracted title of the 'Philosophiæ Naturalis Principia Mathematica,' the great work of Newton, the publication of which is the most remarkable epoch in the history of science. The title-page of the first edition is: '*Philosophiæ Naturalis Principia Mathematica. Autore Is. Newton, Trin. Coll. Cantab., Soc. Matheseos Professore Lucasiano, et Societatis Regalis Sodali. Imprimatur. S. Pepys, Reg. Soc. Præses, Julii* 5, 1686. *Londini, Jussu Societatis Regiæ ac Typis Josephi Streater. Prostat apud plures Bibliopolas. Anno MDCLXXXVII.*'

The object of this article is to describe the publication and the contents of the Principia, with a brief notice of the principal commentaries. The first head, the publication, we should have left untouched, referring to the article NEWTON, if it had not been for the work which the late Professor Rigaud published a short time before his death, entitled 'Historical Essay on the First Publication of Sir Isaac Newton's Principia,' Oxford, 1838. A slight account of this publication, embodying Mr. Rigaud's conclusions, may be usefully appended to the article cited.

Mr. Rigaud appears to receive the common story of the fall of an apple. [NEWTON, p. 201.] It was communicated by Newton's niece to Voltaire, and by her husband, Mr. Conduit, to Fontenelle. It is clear however that Newton first thought on the subject in 1666. With reference to the story of his laying by the theory until Picard's measure of the earth was brought to his notice in 1682 [p. 199], Mr. R. states the fact that Picard's 'Mésure de la Terre' was published in 1671, and much discussed at the Royal Society in the years following.* Moreover Dr. Pemberton, who derived his information from Newton himself, states most explicitly (in his preface) that a letter from Hooke gave occasion to his resuming his old thoughts, and that he then used Picard's measure. This letter from Hooke, the subject of which was the curve in which a falling body descends to the earth, taking into account the earth's motion, is clearly made out to have been written in 1679, which is therefore the date of Newton's resumption of his attempt, not 1682, as generally stated. The new attempt, as every one knows, was more successful, but Newton did not write any treatise nor contemplate any publication; he traced out the foundation of his system, and threw aside his papers. In January,† 1684, Halley had concluded, from Kepler's third law, that the centripetal force on the planets (supposed to move in *circles*) was as the inverse square of the distance. Not being able to proceed further, he applied to Hooke and Wren, the former of whom professed to have solved the whole problem, but would communicate nothing; the latter declared that he had long given over the question from inability to succeed. In August following, Halley paid a visit to Newton at Cambridge, who informed him that he had solved the problem, but *was not able to lay his hand on the papers which contained his solution*, so completely had he thrown the subject aside. After Halley's departure, he worked the theorems out again, and transmitted them to Halley through Mr. Paget, the mathematical master at Christ's Hospital. On receipt of this communication, in November, Halley immediately paid another visit to Cambridge, to gain more information, and to induce Newton to pursue the inquiry. December 10, 1684, Halley stated at the Royal Society that 'he had lately seen Mr. Newton at Cambridge, and that he had shown him a curious treatise *De Motu*, which, upon his desire, he said was promised to be sent to the Society to be entered upon their register.' Halley and Paget were accordingly deputed to keep Newton in mind of his promise (a singular proceeding, showing how well the Society knew Newton's indifference about communicating), and the consequence was, that about the middle of February, 1685, a communication (that previously made to Halley, enlarged), ntitled 'Isaaci Newtoni Propositiones de Motu,' was sent and registered: it contains what were afterwards the main theorems of the early sections of the Principia, direct and inverse, relating to centripetal forces. No Principia as yet existed, and even this basis had only recently been written down satisfactorily. Newton writes to Mr. Aston, Sec. R. S., in acknowledging the news of the above entry, 'I designed them for you before now, bu' the examining several things has taken a greater part of my time than I expected, and a great deal of it to no purpose. And now I am to go into Lincolnshire for a month or six weeks. *Afterwards I intend to finish it* as soon as I can conveniently.' (February 23, 1685.) On this Mr. Rigaud well remarks, 'The Principia was not a protracted compilation from memoranda which might have been written down under the impression of different trains of thought: it had the inestimable advantage of being composed by one continued effort, during which the mutual bearing of the several parts was vividly present to the author's mind.' On the 21st of April, 1686, Halley announced to the Royal Society that Mr. Newton 'had an incomparable Treatise on Motion almost ready for the press;' and on the 28th of the same month Dr. Vincent[*] presented the manuscript of the first book to the Society, who referred the question of printing to the Council, and the production of a report upon the contents to Halley. May 19, the Society decided that the work should be printed forthwith in quarto, &c.; and hence it has always been supposed that the Society paid the expenses of printing, though the title-page only bears 'jussu Societatis,' &c., and not 'jussu et sumptibus,' as usual where it bore the expenses. But Mr. Rigaud quotes the minute of the *Council* of the Society of the 2nd of June, confirming the vote of the *Society* to the extent of resolving 'that Mr. Newton's book be printed,' but adding that 'E. Halley shall undertake the business of looking after it, *and printing it at his own charge, which he engaged to do.*' The fact was, that when the Council came to consider the Society's vote of the 19th of May, they found there was no money; a work of Francis Willughby, 'De Historia Piscium,' published 'jussu et sumptibus,' in 1686, had so reduced their funds, that they were obliged to pay their officers in copies of this very book about fishes.

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* Mr. R. mentions that Newton must have been acquainted with the measures of Snell and Norwood, the result of the former of which appears in his own edition of Varenius. The latter, there can be no doubt, he did not trust; and as to the former, we have shown [MILE] that in this very edition of Varenius, he had allowed gross errors to pass as to the measures of his own country. It may be inferred that he had not much to do with the details of it

† That is, what we call 1684; Halley writes 1683 4. [PERIODS OF REVOLUTION.] All the following dates are for a year beginning in January.

In the meanwhile arose a controversy with Hooke, the universal claimant, who, when the first part of the manuscript was presented by Vincent, asserted that he had discovered the law of the inverse squares, and had communicated that and other discoveries to Newton. The heads of the paper on which he founds his claim are given at length in Hooke, Robert, and they show that though he had (in common with several others) some very correct notions on the subject, he had not even arrived at the knowledge of the law of the inverse squares, though that had been propounded by Bouillaud. Mr. Rigaud enters at great length into this question; if we were to do the same, we should take an advanced position, and before we attempted to show that Hooke did not write any part of the substance of the Principia, we should require reasonable proof that he would have been able to read and understand the mathematical part of it when written: and not until this had been given, which we are convinced could not be given from Hooke's writings, should we consider it necessary to enter on the first point. Had it not been for Halley, this trumpery claim of Hooke's would have produced serious consequences. Newton, easily disgusted by controversy, and having observed that physical questions generally gave rise to it, proposed (in a letter to Halley, June 20, 1686) to omit the third book altogether, which contains the actual application of the first two books to the existing universe. He says, 'The third I now design to suppress. Philosophy is such an impertinently litigious lady, that a man had as good be engaged in lawsuits as have to do with her. I found it so formerly, and now I have no sooner come near her again, but she gives me warning. The two first books, without the third, will not so well bear the title of "Philosophiæ Naturalis Principia Mathematica," and therefore I had altered it to this,—"De Motu Corporum Libri Duo," but upon second thoughts, I retain the former title. 'Twill help the sale of the work, which I ought not to diminish now 'tis yours.' Halley had to soothe this irritation, and prevent the consequences; and as the letter in which he did this is very curious, and has never been printed altogether, except by Mr. Rigaud, the surpassing interest which everything connected with the Principia excites will justify our giving it entire, particularly as it is the original voucher for several of the most important circumstances connected with the publication:—

'London, 29 June, 1686.

'Sir,—I am heartily sorry that in this matter, wherein all mankind ought to acknowledge their obligations to you, you should meet with anything that should give you disquiet; or that any disgust should make you think of desisting in your pretensions to a lady whose favours you have so much reason to boast of. 'Tis not she, but your rivals, envying your happiness, that endeavour to disturb your quiet enjoyment; which, when you consider, I hope you will see cause to alter your resolution of suppressing your third book, there being nothing which you can have compiled therein, which the learned world will not be concerned to have concealed. Those gentlemen of the Society to whom I have communicated it, are very much troubled at it, and that this unlucky business should have happened to give trouble, having a just sentiment of the author thereof. According to your desire in your former, I waited upon Sir Christopher Wren, to inquire of him, if he had the first notion of the reciprocal duplicate proportion from Mr. Hooke. His answer was, that he himself very many years since had had his thoughts upon the making out the planets' motions by a composition of a descent towards the sun, and an impressed motion; but that at length he gave it over, not finding the means of doing it. Since which time Mr. Hooke had frequently told him, that he had done it, and attempted to make it out to him; but that he never was satisfied that his demonstrations were cogent. And this I know to be true, that in January, 1683-4, I, having, from the considerations of the sesquialter proportion of Kepler, concluded that the centripetal force decreased in the proportion of the squares of the distances reciprocally, came on Wednesday to town, where I met with Sir Christopher Wren and Mr. Hooke, and falling in discourse about it, Mr. Hooke affirmed, that upon that principle all the laws of the celestial motions were to be demonstrated, and that he himself had done it. I declared the ill-success of my own attempts; and Sir Christopher, to encourage the inquiry, said that he would give Mr. Hooke, or me, two months' time to bring him a convincing demonstration thereof; and, besides the honour, he of us, that did it, should have from him a present of a book of forty shillings. Mr. Hooke then said, that he had it, but he would conceal it for some time, that others trying and failing might know how to value it, when he should make it public. However, I remember that Sir Christopher was little satisfied that he could do it; and though Mr. Hooke then promised to show it him, I do not find that in that particular he has been so good as his word. The August following, when I did myself the honour to visit you, I then learnt the good news that you had brought this demonstration to perfection: and you were pleased to pro[illegible] me a copy thereof, which the November following I re[illegible] with a great deal of satisfaction from Mr. Paget; and thereupon took another journey to Cambridge, on purpose to confer with you about it, since which time it has been entered upon the Register Books of the Society. As all this passed, Mr. Hooke was acquainted with it, and according to the philosophically ambitious temper he is of, he would, had he been master of a like demonstration, no longer have concealed it, the reason he told Sir Christopher and me now ceasing. But now, he says, this is but one small part of an excellent system of nature, which he has conceived, but has not yet completely made out, so that he thinks not fit to publish one part without the other. But I have plainly told him, that unless he produce another differing demonstration, and let the world judge of it, neither I nor any one else can believe it. As to the manner of Mr. Hooke's claiming the discovery, I fear it has been represented in worse colours than it ought; for he neither made public application to the Society for justice, nor pretended you had all from him. The truth is this: Sir John Hoskyns, his particular friend, being in the chair when Dr. Vincent presented your book, the Doctor gave it its just encomium both as to the novelty and dignity of the subject. It was replied by another gentleman, that you had carried the thing so far, that there was no more to be added. To which the Vice-president replied, that it was so much the more to be prized, for that it was both invented and perfected at the same time This gave Mr. Hooke offence, that Sir John did not, at that time, make mention of what he had, as he said, discovered to him; upon which they two, who till then were the most inseparable cronies, have since scarce seen one another, and are utterly fallen out. After the breaking up of that meeting, being adjourned to the coffee-house, Mr. Hooke did there endeavour to gain belief, that he had some such thing by him, and that he gave you the first hint of this invention. But I found, that they were all of opinion, that, nothing thereof appearing in print, nor on the books of the Society, you ought to be considered as the inventor. And if in truth he knew it before you, he ought not to blame any but himself, for having taken no more care to secure a discovery which he puts so much value on. What application he has made in private, I know not; but I am sure that the Society have a very great satisfaction, in the honour you do them, by the dedication of so worthy a treatise. Sir, I must now again beg you, not to let your resentments run so high, as to deprive us of your third book, wherein the application of your mathematical doctrine to the theory of comets and several curious experiments, which, as I guess by what you write, ought to compose it, will undoubtedly render it acceptable to those who will call themselves Philosophers without Mathematics, which are much the greater number. Now you approve of the character and paper, I will push on the edition vigorously. I have sometimes had thoughts of having the cuts neatly done in wood, so as to stand in the page with the demonstrations. It will be more convenient, and not much more charge. If it please you to have it so, I will try how well it can be done; otherwise I will have them in somewhat a larger size than those you have sent up. I am, Sir, your most affectionate humble servant, 'E. Halley.'

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[*] This gentleman is supposed to have been the husband of a lady to whom Newton was attached in early life.

Newton had completed the first draught of the work by the end of 1685, though none of it was sent till April, 1686. The third book was presented to the Society, April 6, 1687, in proof, probably, since the whole was published (at ten or twelve shillings a copy) about Midsummer, 1687. The order of the Council of the Society to license the book was made on June 20, 1686, and the imprimatur of Pepys was dated July 5.

The part which Halley had in the matter would alone immortalise his name. He found out the ability of Newton to write such a work, prevailed upon him to write it, took charge of the publication, prevented the author from materially mutilating it in disgust, paid the expenses of printing, at a time when, owing to his father's death and consequent litigation, he had nothing to spare (which never happened to him before or after), gave a copious explanation of it in the Philosophical Transactions, and is generally admitted to have been for a long time the only person in Europe who showed that he thoroughly appreciated the value of the work, and knew the place it must occupy in the history of discovery.

The interest attached to the second and third editions of the Principia (superintended by Cotes in 1713, and by Pemberton in 1726) is considerable, with reference to the alterations made in them by Newton. It would not however be worth while to specify these alterations, which are numerous, some in correction of errors, others in extension of views. With reference to the suppression of the celebrated Scholium, see Commercium Epistolicum and Fluxions.

The Principia of Newton contains the dedication to the Royal Society, a short preface, verses by Halley in honour of Newton, definitions, axioms, a first book on unresisted motion, a second on resisted motion, and a third on the system of the universe. Halley's verses were somewhat altered by Bentley in the second edition, but the original readings were very nearly restored in the third. Newton wrote a short preface for each of the editions, and Cotes one of considerable length for the second. The dates of the Newtonian prefaces are, May 8, 1686; March 28, 1713; January 12, 1725-6. The following is the description of the contents of the third edition:

The definitions comprise, 1. Quantity of matter measured by density and volume jointly. 2. Quantity of motion [Momentum] by velocity and quantity of matter jointly. 3. Vis insita, or vis inertiæ. [Inertia.] 4. Vis impressa, or external force. 5. Centripetal force. 6. Absolute magnitude of centripetal force. 7. Accelerating force. 8. Moving force. A scholium is added on time, space, and motion, the latter considered absolutely and relatively.

The axioms are the three laws of motion [Motion, Laws of] and certain corollaries, namely: 1. The composition of velocities and forces. 2. Their resolution, and deduction of the property of the lever. 3. Momentum of a system in a given direction not changed by the mutual action of the parts. 4. Nor the motion of the centre of gravity. 5. Relative motion of bodies not altered by absolute motion of the space they move in. 6. Nor by equal and parallel accelerating forces applied to all. A scholium is added, containing the experimental verifications of the third law in the cases of impact, attraction, and operation of machines.

The First Book*, on unresisted motion, consists of fourteen sections, and ninety-eight propositions. The numbers in parentheses refer to the propositions.

Section 1 contains eleven lemmas and a scholium. This section is explanatory of Newton's peculiar mode of reasoning, which subject, with the contents of this section, will be treated under Ratios, Prime and Ultimate.

Section 2. On Centripetal Forces. (1) Equal areas are described in equal times. Six corollaries on the comparison of velocities and forces; the former inversely as the perpendiculars on the tangents, the latter as the sagittæ of arcs described in equal times. (2) If equal areas be described in equal times about a centre, fixed or moving straightly and uniformly, the force is centripetal. Two corollaries and scholium. (3) In equiareal motion of a point about a moving centre, that point is acted on by a centripetal force, and by all by the accelerating forces which act on the centre. Four corollaries and scholium. (4) In different circles uniformly described, force varies as (vel)^2 ÷ rad. Nine corollaries and scholium indicating the deduction in the case of the planets. (5) Given the velocities in different parts of an orbit, to find the centre of force. (6) Centripetal force in the middle of a small arc is as sagitta ÷ (time)^2. Five corollaries; various ways of comparing forces. (7) The orbit circular, centre anywhere within, to find the law of force. 3 Cor. (8) Ditto, ditto, where the forces act in parallel lines. Scholium; same considerations apply to other conic sections. (9) Law of force in equiangular spiral. Lemma 12 (the numbering of t[illegible]mmas runs on from the first section), Equality of par[illegible]logram about conjugates in conic sections. (10) Law of force in ellipse about the centre. 2 Cor and Schol.; e[illegible]n to the parabola.

Section 3. [illegible] in conic sections about the focus. (11) Law of force in ellipse about focus. (12) Same for hyperbola. Lemma 13, Latus rectum in parabola always four times focal distance. Lemma 14, Perpendicular on tangent of parabola, mean between focal distances of point of contact and vertex. 3 Cor. (13) Law of force in parabola about focus. 2 Cor. (14) In conic sections about same focal centre, latera recta are in duplicate ratio of areas described. 1 Cor. (15) In ellipses, periodic times are in sesquiplicate ratio of major axes. 1 Cor. (16) And velocities are as perpendiculars on tangents inversely, and subduplicate ratio of latera recta directly. 9 Cor.; comparison of velocity in conic section and circle. (17) Given initial position and velocity, required conic section described. 4 Cor. and Schol.

Section 4. On finding conic sections from a given focus, and *Section* 5. On finding conic sections of which no focus is given. These sections, which carry on the lemmas from 15 to 27, both inclusive, and the propositions from (18) to (29), both inclusive, are entirely geometrical exercises in drawing conic sections through given points, or touching given straight lines, &c.: the results are hardly of use, even in the rest of the work, and a particular reference would now be of no use whatever.

Section 6. On finding the motion in a given orbit. (30) To find the place of a body in a parabola at the end of a given time. 3 Cor. Lemma 28, There is no oval figure whose area contained being any two radii, can be obtained by an equation in finite terms. [Quadrature of the Circle.] 1 Cor.; relates to the ellipse. (31) To find the place of a body in an ellipse at the end of a given time. Scholium; approximate method.

Section 7. On rectilinear ascent and descent. (32) Required the space described in a given time by a body descending towards a centre*. Three cases, derived from the three conic sections. (33) Law of the velocity in the preceding, in the cases derived from the ellipse and hyperbola. 2 Cor. (34) The same in the case derived from the parabola. (35) An equable description of certain areas in the conic sections just alluded to takes place during the motion. (36) The time of the whole descent of a body from rest. (37) The time of the whole descent of a projected body. (38) Velocity and time determined in descent to a centre, the force being as the distance. 2 Cor. (39) Granting the quadrature of curves [Quadrature], and the law of force being any whatever, to determine the time and velocity at any point of a descent. 3 Cor.

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* This description is for reference, not for explanation, and is therefore very briefly given. To give an account of every corollary and scholium would have extended the article to a great length: hence only some of the more important of them are described. But the references to other articles in this work are for the elementary student.

* The law of force, where not otherwise specified, is always as the inverse square of the distance.

Section 8. Determination of the orbit under any law of centripetal force. (40) The velocity at a given distance is always the same both in an orbit and a descent, if it be the same at any one distance in both. 2 Cor. (41) Granting the quadrature of curves, to find the orbit and the time of describing an arc, under any law of force. 3 Cor. (42) The same, the initial velocity and direction being given.

Section 9. On the motion of bodies in moveable orbits, and on the motion of the apsides. (43) How to make a body revolve equiareally in both a moving orbit and in the same fixed. (44) The difference of forces in the two cases is as the inverse cube of the distance. 6 Cor.; mostly exhibiting the conclusion in algebraical form. (45) To find the motion of the apsides in orbits nearly circular. 3 Examples; 2 Cor.

Section 10. On the motion of bodies in given surfaces, and on pendulous motions. (46) Given a plane, and a centre of force external to it, to find the motion of a point parallel to that plane, the law of force being any whatever. (47) The force in the last being as the distance, the orbit parallel to any plane must be an ellipse, and in all such ellipses the time of revolution is the same, and the same as that of a double ascent and descent. Schol. (48) and (49) Rectification of the epicycloid and hypocycloid. 3 Cor. (50) Way to make a body oscillate in a given hypocycloid. Cor. (51) If the force tending to the centre of the fixed circle in such an oscillation be as the d[illegible]ce, the times of all such oscillations are equal. Cor. (5[illegible]) Determination of the velocity and time at any point of such an oscillation. 2 Cor.; the second being an applicati[illegible] the common cycloid. (53) On a given curve, to fi[illegible] law of force which gives isochronous oscillations. 2 Cor. (54) A body moving on a rigid curve, under a given law of centripetal force, to find the time of its oscillations. (55) If a body move on a surface of revolution, the centre of force being in the axis, equal areas are described in equal times on a plane perpendicular to the axis. Cor. (56) To find the curve described in the last case.

Section 11. On the motion of bodies centripetally attracted to each other. (57) Two bodies, mutually attracting, describe similar figures about each other and about their common centre of gravity. (58) And with the same forces, the same curve may be described by either about the other at rest. 3 Cor. (59) Relation of the periodic times about the centre of gravity, and of one body about the other at rest. (60) In the same two cases, relation of the axes of the ellipses described. (61) And for any law of force, the bodies move round their centre of gravity as if a third body were placed in that centre, attracting with the same law of force. (62) Determination of the descent towards each other of two mutually attracting bodies. (63) Determination of the orbits of two such bodies, with given initial velocity and direction. (64) The force being as the distance, determination of the relative motions of several bodies. (65) The force being inversely as the square of the distance, and there being several bodies, one may move round another in an ellipse *nearly*, and describe areas nearly proportional to the times. 3 Cor. (66) The celebrated proposition of the three bodies, showing the diminution of the disturbance by the third body attracting both the others. (In the corollaries following, let the earth and moon, for distinctness sake, be the two bodies, and the sun the disturbing body: but let it be remembered that Newton does not mention the name of any planet nor hint at any application.) Cor. 1, If the earth had more satellites, the same proposition would apply to one as disturbed by the rest. Cor. 2 and 3, The moon moves quickest, ceteris paribus, in conjunction and opposition, and slowest in quadratures. Cor. 4, The moon's orbit is more curved in quadratures than in syzygies. Cor. 5, Hence, excentricity being excluded, the moon is farther from the earth in quadratures than in syzygies. Cor. 6, Explanation of the effect of the variation of the sun's distance on the moon's period. Cor 7, The moon's apsides progress and regress, but the former more than the latter. Cor. 8, Effect of the position of the apsides with respect to the sun. Cor. 9, Effect on the excentricity of the moon's orbit. Cor. 10 and 11, Effect on the inclination and place of the nodes. Cor. 12, Disturbance rather greater in conjunction than in opposition. Cor. 13, The same species of effect produced whether the disturbing body is the greater or the less of the three. Cor. 14, 15, 16, 17, On the dependence of the disturbing forces on the distance of the disturbing body. C
18, 19, 20, 21, 22, Explanation of precession of equinoxes
tides. (67) The disturbing body describes areas more nea
proportional to the times about the centre of gravity of
other two bodies than about either of them, and an or
more nearly elliptic. (68) And the more so on account
its attracting the other bodies. Cor. (69) The attracti
forces of bodies are, ceteris paribus, as their masses. 3 C
and Scholium.

Section 12. On the attractions of spherical bodies. (
A particle placed inside a spherical shell is in equilibriu
(71) Spherical shells attract as if their whole masses w
collected at their centres. (72) The attractions of sphe
on points similarly placed with respect to them are as th
diameters. 3 Cor. (73) At different internal points o
solid sphere the attractions are as the distances from
centre. Schol. (74) Solid spheres attract as if the wh
masses were collected at their centres. 3 Cor. (75) T
same of spheres attracting spheres. 4 Cor. (76) The sa
of spheres consisting of concentric layers of unequal densi
9 Cor. (77) The same is true when the forces of partic
to each other are as their distances. (78) With the sa
law, the same is true of spheres consisting of concent
layers. Cor. and Schol.: Lemma 29. (79); (80), 4 Co
(81), 3 Exam.; (82); these show the method of finding
attraction of any sphere on a point without it, for any
of force. (83) The force being as the inverse *n*th power
the distance, to find the attraction of a segment of a sph
on a particle at its centre. (84) The same when the parti
is not in the centre. Schol.

Section 13. On the attractions of non-spherical bod
(85) If the attraction of the body on a contiguous parti
be much greater than on one at a little distance, the attr
tion of the molecules of the attracting body diminishes i
higher ratio than the inverse square of the distance. (
And the hypothesis of the last is a consequence, if
attraction of the molecules diminishes as the inverse cu
of the distance, or faster. (87) If two similar bodies of
same material attract two molecules proportional to the
selves and similarly placed, the attractions of the molecu
on the two bodies will be proportional to their attracti
on their similar particles similarly placed. 2 Cor. (88)
the particles of a body attract a molecule with forces
their distances, the whole attraction of the body will
towards its centre of gravity, and equal to that of a sph
equal to the body, and having its centre in that centre
gravity. Cor. (89) And the same if there be several bod
Cor. (90) To determine the attraction of a circle on a p
in its axis. 3 Cor. (91) To determine the attraction o
solid of revolution on a point in its axis. 3 Cor. relating
cylinders and spheroids. (92) Given an attracting bo
to find (experimentally) the law of attraction of its partic
(93) If particles attract as the inverse *n*th power, a so
bounded by a plane, but indefinitely extended in all dir
tions on one side of that plane, will attract an external p
ticle with a force proportional to the inverse ($n-3$)rd po
of the distance from that plane. 3 Cor., Schol.

Section 14. On the motion of particles from one medi
into another. (94) If a particle pass through a medi
contained between parallel planes, and be in its pass
attracted to or repelled from the boundary of the mediun
has left with a force depending on the distance from
boundary; the sine of the angle of emergence is always
a constant ratio to that of incidence. (95) And the ve
city before incidence is to that after emergence as the s
of the angle of emergence to that of incidence. (96) A
if the velocity must be greater before than after inciden
the angle of incidence may be made so great that the p
ticle shall be reflected, and the angles of incidence and
flexion are equal. Scholium. (97) To give the bound
separating two media such a form that all particles issu
from one point may be refracted to another. 2 Cor. (
To form a lens which shall have the property mentioned
the last. Scholium.

THE SECOND BOOK, mostly on resisted motion, conta
9 sections and 53 propositions.

Section 1. When the resistance is as the velocity.
The motion lost is as the space described. Cor. Lemma
(2) When no forces act but the resistance, the velocities
the beginnings of successive equal times are in geometri
progression, and the spaces described as the velocities. C
(3) To determine the resisted motion of ascent or desc
when the force of gravity acts. 4 Cor. (4) The same wh

the particle is projected obliquely. 7 Cor., and Scholium, to the effect that the hypothesis is 'magis mathematica quam naturalis.'

Section 2. When the resistance is in the duplicate ratio of the velocity. (5) When no force acts, equal spaces are described in times which are in increasing geometrical progression; the velocities at the beginning of the times being in the inverse geometrical progression. 5 Cor. (6) Equal and homogeneous spheres, acted on by no forces, describe equal spaces in times which are reciprocally as their initial velocities, in which also they lose the same parts of their velocities. (7) Also, in times which are as the first velocities directly and the first resistances inversely, they lose the same fractions of their velocities, and describe spaces jointly proportional to the times and the first velocities. 5 Cor. Lemma 2; which answers to finding the fluxions (called here momenta) of simple algebraical quantities. 3 Cor. and *Scholium*. [FLUXIONS.] (8) When a particle descends or ascends by gravity, the whole forces (gravity and resistance compounded) at the beginning of equal successive spaces, are in geometrical progression. 3 Cor. (9) Determination of the proportions of the times of ascent and descent in the last. 7 Cor. (10) The law of resistance being jointly as the density and the square of the velocity, required the law of density so that (gravity acting) a given curve may be described; as also the law of velocity. 2 Cor., followed by 4 Examp. and Schol., and also by 8 rules.

Section 3. When the resistance is partly as the velocity, partly as its square. (11) No force acting, and times being taken in arithmetical progression, the reciprocals of the velocities, increased by a certain constant quantity, will be in geometrical progression. 2 Cor. (12) But if spaces be taken in arithmetical progression, the velocities increased by a constant quantity will be in geometrical progression. 3 Cor. (13) Gravity acting, the relation between the time and velocity in the ascent or descent is shown. Cor. and Schol. (14) Relation connecting the space described with the preceding. Cor. and Schol.

Section 4. On spiral motion in a resisting medium. Lemma 3. A property of the equiangular spiral. (15) The density being inversely as the distance from the centre, and the centripetal force inversely as its square, the particle can revolve in an equiangular spiral. 9 Cor. (16) And, other things remaining, the same can be when the force is inversely as any power of the distance. 3 Cor. and Schol. (17) To find the force and law of resistance, by which a body may move in a given spiral, with a given law of velocity. (18) Given the law of force in the last, to find the density of the medium.

Section 5. On the density and compression of fluids, and on hydrostatics. Definition of a fluid. (19) A homogeneous fluid compressed in a close vessel (gravity, &c. apart) is everywhere equally pressed, and at rest. 7 Cases and Cor. (20) If a solid sphere form the nucleus of a fluid mass bounded by a concentric sphere, and the parts of the fluid gravitate equally to the centre at equal distances, the pressure sustained by the sphere is the weight of a cylinder which has the superficies for its base and the height of the incumbent fluid for its altitude. 9 Cor. (21) The density being proportional to the compression, and the centripetal force of particles inversely as their distance from the centre, then at distances in geometrical progression, the densities will be also in geometrical progression. Cor. (22) But if the force be inversely as (dist)^2, then at distances in harmonical progression the densities will be in geometrical progression. Cor. and Schol. (23) If the particles of the fluid repel each other, the density is as the compression (and then only) when the repellent force of two particles is inversely as the distance of their centres. Scholium. (In consequence of the particles being supposed to repel only their nearest, Newton treats this only as a purely mathematical result.)

Section 6. On the resisted motion of pendulums.* (24) The quantity of matter in pendulums of the same length, is in a ratio compounded of their weights and of the duplicate ratio of their times of oscillation in vacuo, 7 Cor. (25) A pendulum which moves in a medium in which the resistances are as the *moments* of the times, and another moving unresisted in a medium of the same specific gravity, make their cycloidal oscillations in the same times, and describe proportional parts of their arcs together. Cor. (26) Resistance being as the velocity, cycloidal oscillations are isochronous. (27) Resistance being as the (velocity)^2, the difference between the time of cycloidal oscillation in a resisting medium and a non-resisting one of the same specific gravity, will be very nearly as the arcs of oscillation. 2 Cor. (28) The resistances being as the moments of the time, the resistance is to the force of gravity as the excess of an arc of descent (cycloidal) over the subsequent arc of ascent to the square of the length of the pendulum. (29) Resistance being as (velocity)^2, to find the resistance at any point of a cycloidal oscillation. 3 Cor. (30) Easier method of exhibiting the difference of an arc of descent and ascent. Cor. (31) If the resistance be altered in a given ratio, the difference of the arcs of ascent and descent is altered in the same ratio. Scholium Generale, containing many experimental results.

Section 7. On the motion of fluids and resistance of projectiles.* (32) Two systems of similar particles similarly placed, with given ratios between their densities, and beginning to move similarly in proportional times, will continue to do so, if there be no contact of particles except at instants of reflexion, and if there be no attracting forces of particles on one another but such as are as the diameters of corresponding particles inversely and the square of the velocities directly. 2 Cor. (33) And finite parts of these systems are resisted in a ratio compounded of the duplicate ratio of the velocities and diameters, and the ratio of the densities. 6 Cor. (34) The circular end of a cylinder encounters twice as much resistance as a sphere moving with the same velocity. Scholium, containing among other things the construction (without demonstration) of the solid of least resistance, which shows that Newton must have carried his fluxions (before 1687) far enough to solve some problems at least in what is now called the calculus of variations. (35) A medium consisting of equal particles at equal distances, to find the resistance it offers to a sphere. 7 Cor. and Schol. (36) To find the motion of water issuing through an orifice at the bottom of a cylinder. 10 Cor. Lemma 4. (37) Resistance to a cylinder moving in a non-elastic fluid. 3 Cor. and Schol. Lemma 5, 6, 7. A cylinder, sphere, or spheroid, of the same circular section, placed in a cylindrical canal of running water, or moving equally in it, are equally urged or resisted. Schol. (38) Resistance to a globe in a non-elastic fluid. 4 Cor. (39) The same when the globe is in a cylindrical canal. Schol. (40) The same, showing how to find the resistance experimentally. Scholium, containing accounts of fourteen experiments.

Section 8. On motion propagated through a fluid. (41) Pressure is not propagated through a fluid in right lines, unless when the particles lie in right lines. Cor. (42) Every motion propagated through a fluid diverges from the direct path. (43) Every tremulous body excites in an elastic medium pulses in every direction; but in a non-elastic medium, a circular motion. Cor. (44) 3 Cor. (45) Oscillation of water in a bent tube. (46) The velocity of waves. 2 Cor. (47) In pulses, the motion of the particles follow the law of an oscillating pendulum.† Cor. (48) The velocities of pulses in different media are as the square roots of the elastic force directly and the density inversely. 3 Cor. (49) Given the density and elasticity, to find the velocity 2 Cor. (50) To find the length of the pulses. Scholium.

Section 9. On the circular motion of fluids. (Refutation of Des Cartes's vortices on the hypothesis that the resistance which arises from the want of *lubricity* of the parts of a fluid, is proportional to the velocity with which the parts of the fluid are separated.) (51) If a cylinder of infinite length revolve about its axis in a uniform and infinite fluid, and create a vortical motion, the periodic times of the particles of fluid are as their distances from the axis. 6 Cor. (52) But if the revolving body be a sphere, these periodic times are as the squares of the distances from the centre. 11 Cor. and Schol. (53) A body revolving in a vortex so as to return to its place, must be of the same density as the parts of the vortex, and move in the same manner. 2 Cor. and Scholium; completing the refutation above mentioned.

The THIRD BOOK, or application, styled 'De Systemate Mundi,' contains forty-two propositions, and preliminaries. It is to be noted that it was the original intention of Newton that this book should be a popular one; and the original draft (so it is considered by Mr. Rigaud) was preserved, and was published in English, in 1728, under the title of 'The System of the World demonstrated in an Easy and Popular Manner by the illustrious Sir Isaac Newton;' and again in the original Latin. It is Opusculum XVII. in the collection of Castillioneus, who takes it from an edition published in 1731. It is not altogether popular, but, containing the mathematical propositions concerning comets to which Halley alludes in his letter, is doubtless the third book as it stood at the time when the idea of suppressing it was in Newton's mind.

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* Some of these propositions would require explanation to make their meanings clear, which we have not here room to give.

* See note in preceding column.

† Lagrange has shown (*Misc. Taur.*) that the method of Newton here only leads to a concealed identity, which proves nothing.

Regulæ philosophandi. 1. No more causes of natural things are to be admitted than are both true and sufficient to explain their phenomena. 2. The same causes are to be assigned to effects of the same kind, as far as that can be done. 3. Those qualities of bodies which can neither be strengthened nor weakened, and which belong to all bodies which are capable of being tried, are to be considered as universal qualities. 4. In experimental philosophy, all propositions collected by induction from phenomena are to be held either exactly or approximately true until other phenomena are found by which those propositions can be made either more accurate or subject to exception.

Phenomena. 1. The satellites of Jupiter describe areas proportional to the times about the planet, and their periodic times are in the sesquiplicate ratio of their distances from the planet. 2. The same is true of the satellites of Saturn (five then known). 3. The five primary planets, Mercury, Venus, Mars, Jupiter, and Saturn, revolve about the sun. 4. And their periodic times, and that of the earth about the sun, or the sun about the earth, the fixed stars being at rest, are in the sesquiplicate ratio of their mean distances from the sun. 5. And the primary planets are very far from describing equal areas in equal times about the earth; but do so about the sun. 6. The moon describes equal areas in equal times about the earth.

(1) The satellites of Jupiter are attracted to the planet by forces inversely as the squares of their distances. (2) The same of the primary planets about the sun. (3) The same of the moon about the earth. (4) The force which retains the moon in her orbit is the same force as that which, at the earth's surface, we call gravity. Schol. This is the celebrated test-proposition, the failure of which, in the first instance, made Newton lay his theory aside. (5) A similar result inferred as to satellites about their primaries, and primaries about the sun. 3 Cor. and Schol. (6) All bodies gravitate towards every planet; and gravitation towards every planet, at a given distance from it, is as the mass of that planet. 5 Cor. (7) Attraction belongs to all bodies, and is proportional to the quantity of matter in them. 2 Cor. (8) If each of two globes be everywhere of one density at one distance from the centre, the attraction of each on the other is inversely as the square of the distance of their centres. Cor. 4. (9) In descending to the centre of a planet, gravity diminishes as the distance from that centre. (10) The motion of the planets can continue for an immensely long time.

Hypothesis 1. The centre of the solar system is at rest. (Newton takes the universally admitted hypothesis, and shows what the long disputed centre of the system is.) (11) The centre of gravity of the whole system is at rest. (12) The sun is perpetually in motion, but never far from the centre of gravity of the whole. Cor. (13) The planets move in ellipses, having their focus in the sun's centre, and they describe equal areas in equal times about that focus. (14) The nodes and aphelia of the planets are at rest. 2 Cor. and Schol. modifying the proposition by considerations of perturbation. (15) To find the axes of the orbits. (16) To find the eccentricities and aphelia. (17) The diurnal motion of the planets is uniform, and the libration of the moon arises from the diurnal motion. (18) The figures of the planets are oblate. (19) To find the proportions of the axis of a planet. (20) To compare the weights of bodies at different parts of the earth. (21) The equinoctial points must regress, and the axis of the earth must have a nutation twice in each year. (22) All the lunar motions and inequalities follow from the preceding principles. (23) The inequalities of other satellites may be derived from those of the moon. (24) The tides of the sea arise from the actions of the sun and moon. (The Jesuits' edition inserts in this place the treatises of Daniel Bernoulli, Maclaurin, and Euler, on the tides.) (25) To find the disturbing force of the sun upon the moon. (26) To find the horary increment of the moon's area about the earth. (27) From the moon's horary motion to find its distance from the earth. 2 Cor. (28) To find the diameters of the orbit in which the moon would move, but for excentricity. (29) To find the variation of the moon. (30) To find the horary motion of the moon's nodes in a circular orbit. [illegible] Cor. [illegible] To find the horary motion of the moon's nodes in an elliptic orbit. Cor. (32) To find the mean motion of the moon's nodes. (33) To find the true motion of the moon's nodes. Cor. (Newton, in the third edition, here adds Machin's method of finding the motion of the moon's nodes.) (34) To find the horary variation of the moon's inclination. 4 Cor. (35) To find the moon's inclination at a given time. Schol. giving an account of several other peculiarities of the lunar motions, and completing the lunar theory. (36) To find the force of the sun upon the sea. Cor. (37) The same for the moon. 10 Cor. (38) To find the figure of the moon. Cor. Lemma, 1, 2, 3. On the effect of a ring of matter at the equator, disturbed by the sun, upon the earth's rotation. *Hypothesis* 2.* The effect of such a ring in causing precession is the same whether the ring be fluid or solid. (39) To find the precession of the equinoxes. Lemma 4. Comets are above the moon, and in the planetary regions. 3 Cor. (40) Comets revolve in conic sections, having the sun in a focus, and describe equal areas in equal times. 4 Cor. Lemma 5. To find a curve of the parabolic kind, which shall pass through any number of given points. Cor. Lemma 6. From any given places of a comet to find its place at any intermediate time. Lemmas 7, 8, 9, 10, 11. On the parabola, preparatory to the next propositions. (41) To find the parabolic orbit of a comet, from three observations. Example, the comet of 1680, from various observations, and a long discussion of the physical characters of comets. (42) To correct the orbit of a comet; with other examples and discussions. It is to be understood that throughout this third book continual comparison with observation occurs, which it is unnecessary to repeat as to each particular case, since the purpose of the book itself is the comparison of the results of theory with observation.

The *Scholium generale*, at the end of the Principia, has been so often quoted, alluded to, attacked, or brought forward as Newton's final explanation of the metaphysics (if that be a proper word) of his system, that even as a matter of reference we may be justified in translating it entire. It is not found in the first edition. Two notes, as marked, are Newton's.

'The hypothesis of vortices is encumbered with many difficulties. Since a planet's radius describes areas proportional to the times, the periods of the parts of the vortex should be in the duplicate ratio of their distances from the sun. And since the planets' periods are in the sesquiplicate ratio of their distances, the periods of the parts of the vortex should also be in that ratio. Since the minor vortices about Jupiter, Saturn, &c. preserve their rotation, and swim quietly in the vortex of the sun, the periodic times of the parts of the solar vortex should be equal. The revolutions of the sun and planets about their axes, which should agree with the motions of the vortices, differ from all these proportions. The motion of comets is highly regular, follows the same laws as that of the planets, and cannot be explained by vortices. They are carried [illegible] excentrically to all parts of the heavens, which could not be unless the vortices were removed.

'Projectiles, in our atmosphere, feel only the resistance of the air; take that away, as in Boyle's vacuum, and the resistance ceases, since the light feather and the solid gold fall with the same velocity in this vacuum. And such is the case in the celestial spaces which are above the atmosphere of the earth. All bodies in those spaces must move perfectly freely; and hence the planets move perpetually, according to the laws explained, in orbits of given form and position. They will persevere in their orbits by the laws of gravity; but they could by no means originally have taken that regular orbital path by the same laws.

'The six principal planets revolve about the sun in circles concentric with the sun, in the same direction, and very nearly in the same plane. The ten moons revolve about the earth, Jupiter, and Saturn, in concentric circles, in the same direction, and very nearly in the plane of their planets' orbits. And all these regular motions have no origin in mechanical causes*; for the comets are freely carried in very excentric orbits, and through all parts of the heavens. By such motion comets pass freely and easily through the planetary orbits, and in their aphelia, where they move more slowly and remain longer, they are very distant from each other, and attract each other very little. This most elegant group of sun, planets, and comets can only arise from the design and government of a powerful and intelligent being. And if the fixed stars be centres of like systems, all these constructions of a similar design must be under the dominion of one being: the more since the light of the fixed stars is of the same nature as that of the sun, and all the systems give light to each other. And that the systems of the fixed stars may not fall into each other, he has placed them at immense distances from each other.

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* In the first edition this is a lemma, which probably appeared to Newton to need no proof, as none is given. In the third it is, as we see, made an assumption. Laplace has confirmed it by showing that the precession and nutation would remain unaltered, if the whole sea were at any one moment to be solidified without alteration of its specific gravity.

'He rules all things, not as the soul of the world, but as the lord of all things. And from his dominion, God the Ruler is often called Παντοκράτωρ. For God is a relative term, which refers to his servants; and deity is the rule [illegible] God, not over his own body, as those think who call him the soul of the world, but over his servants. The most high God is a being eternal, infinite, absolutely perfect; but a being however perfect, without dominion, is not God the Ruler. For we say, my God, your God, the God of Israel, the God of gods, the Ruler of rulers; but we do not say, my eternal one, your eternal one, the eternal one of Israel, the eternal one of gods; we do not say, my infinite one, or my perfect one. These appellations have no relation to servants. The word God always† signifies ruler; but every ruler is not God. The rule of a spiritual being makes him God, true rule a true god, the highest rule the highest god, a feigned rule a feigned god. And from the reality of his dominion it follows that the true God has life, intellect, and power; and from his other perfections, that he is the highest or most perfect being. The Eternal is infinite, omnipotent, and omniscient; that is, endures from eternity to eternity, and is present from infinity to infinity; he rules all and knows all that is or can be. He is not eternity nor infinity, but eternal and infinite; he is not time nor space, but endures and is present. He endures for ever, and is everywhere present; and by his universal existence, both in time and space, he is the creator‡ of time and space. Since any particle of space always is, and also some one indivisible moment of duration, certainly the framer and ruler of all things can never be nonexistent at any time or in any place. Every thinking soul is, at different times, and in its different organs of sense or motion, the same indivisible person. There are parts of time successive, and parts of space co-existing; but neither in the person of man, that is, in his thinking principle, and much less in the thinking substance of God. Every man, considered as a sentient existence, is one and the same man throughout his whole life, and in every one of his organs of perception. God is one and the same God always and everywhere. He is omnipresent, not only virtually but substantially; for the first without the second cannot be. In him§ all things are contained and moved, but without mutual effect from each other. God no way feels the motion of bodies; they feel no resistance from the omnipresence of God. All men confess that the most high God exists necessarily, and by the same necessity always and everywhere. Whence also he is throughout alike, all eye, all ear, all brain, all arm, all thought, understanding and action, not in the human or corporeal manner, but in one altogether unknown. As a blind man has no idea of colour, so we have no idea of the modes in which the all-wise God perceives and understands all things. He is altogether without body or figure, and thence can neither be seen, heard, touched, nor worshipped under the likeness of any corporeal thing. We have ideas of his attributes, but we know nothing of the substance of any thing. We see only the figures and colours of bodies, we hear only sounds, we touch only external surface, we smell only odours, and taste tastes: we can perceive the inmost substance by no sense, by no reflected action; much less can we have an idea of the substance of God. Him we know only by his properties and attributes, and by the most wise and excellent structure and final causes of things; and we wonder at him for his perfections, but we venerate and worship him for his dominion. We worship him as servants, and a God without dominion, providence, and final causes is nothing else but fate and nature. From a blind metaphysical necessity, which is certainly the same always and everywhere, no variation of things can arise. Every diversity of created things in space and in time can only arise from the ideas and the will of a necessarily existing being. But God is said allegorically to see, hear, speak, laugh, love, hate, desire, give, receive, rejoice, be made angry, fight, work, build, and construct. For every expression concerning God is drawn from human affairs by a certain figure of similitude, not perfect indeed, but something like. And this much of God, of whom it [illegible]rly belongs to natural philosophy to treat from phenomena.

So far I have explained the phenomena of our heavens and the sea by the force of gravity: but I have not yet assigned the cause of gravity. Certainly this force arises from some cause, which penetrates even to the centre of the sun and planets, without diminution of its virtue; and which acts not according to the superficial magnitude of particles (as do many mechanical causes), but according to the quantity of solid matter; and of which the action is extended in every direction to immense distances, diminishing always in the duplicate ratio of the distances. Gravity towards the sun is compounded of the gravity towards all the several particles of the sun, and in receding from the sun diminishes accurately in the duplicate ratio of the distances, as far as the orbit of Saturn, as is made manifest by the quiescence of the aphelia of the planets, and even as far as the aphelia of the comets, if they also do not move. But I have not yet been able to deduce the reason of these properties of gravity from phenomena, and I do not frame hypotheses. For whatever is not deduced from phenomena, is to be called *hypothesis*: and hypotheses, whether metaphysical or physical, or of occult qualities, or mechanical, have no place in *experimental philosophy*. In this philosophy propositions are deduced from phenomena, and are rendered general by induction. So impenetrability, mobility, the impetus of bodies, and the laws of motion and gravity have become known. And it is enough that gravity really exists and acts according to laws explained by me, and suffices for all the motions of the heavenly bodies and of our sea.

'I might add something on that most subtile spirit which pervades solid bodies and lies hidden in them, by the force and action of which the particles of bodies attract each other at the smallest distances, and adhere when contiguous: and by which electric bodies act at greater distances, both by attracting and repelling neighbouring particles; and by which light is emitted, reflected, refracted, inflected, and gives heat to bodies; and by which all sensation is excited, and the limbs of animals are moved at pleasure, namely, by its vibrations through the solid capillaments of the nerves, propagated from the external organs of sense to the brain, and from the brain to the muscles. But this could not be explained in few words; nor is there a sufficient quantity of experiments to show and determine the laws according to which this *spiritus* acts.'

There is not a sentence of the preceding scholium which has not a direct reference to some common opinion, at home or abroad, of the physics, metaphysics, or theology of Newton's system. He had probably seen and heard enough, in the interval between the editions, to teach him on what points explanation was desirable; certain it is, that there is hardly an objector since his time who might not have found himself already answered, if he had read this scholium with candour and attention.

The commentators of Newton have one and all, as might be supposed, treated their author as a source of elementary instruction, to be explained and cleared from the effects of that brevity and obscurity (the latter more than due to the former) which the *Principia* almost everywhere presents. But the time has arrived when this work is hardly in the beginner's course, though it may be recommended to him, when he has studied the modern analysis, to make himself acquainted with its methods, until he has caught their spirit. What we now want is rather an historical commentary, which shall put the student in possession of the modes of reasoning peculiar to Newton's predecessors, shall point out how the Principia came to have its form, and shall place him, as far as is possible, in the midst of that atmosphere of remnants of the old philosophy and aspirations after the new, in which the mind of Newton gained its growth.

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* By *causa mechanica* Newton means a material machinery, such as the solid orbs of some of the Ptolemaists.

† 'Our countryman Pocock derives the word Deus from the Arabic *du* (sometimes *di*), which means ruler. And in this sense the princes are called gods. *Psalms*, lxxxiv. 6, and *John*, x. 45. And Moses is called God of his brother Aaron, and of king Pharaoh, *Exodus*, iv. 16, and vii. 1. And in the same sense the souls of departed princes were called gods by Gentile nations, but falsely from want of dominion.' (Author's note.)

‡ 'Et existendo semper et ubique durationem et spatium *constituit*.'

§ 'So thought the antients, as Pythagoras (Cic., *De Nat. Deor.*, lib. i.); Thales; Anaxagoras; Virgil (*Georgics*, iv. 220, *Æn.*, vi. 721); Philo (*Allegor.*, lib. i. sub init.); Aratus (*Phæn.*, sub init.) So also the sacred writers, as Paul, *Acts*, xvii. 27, 28; John, *Gospel*, xiv. 2; Moses, *Deut.*, iv. 39, and x. 4; David, *Psalms*, cxxxix. 7, 8, 9; Solomon, 1 [illegible] 27; *Job* xxii. 12, 13, 14; *Jeremiah*, xxiii. 23, 24. The idolaters fals[illegible]posed the sun, moon, and stars, the souls of men, and other parts of the [illegible] to be parts of the most high God, and therefore to be worshipped.' (Author's note.)

In 1730, Dr. John Clarke published 'A Demonstration of some of the principal sections of Sir I. Newton's Principles,' &c. This work contains the greater part of the first book somewhat expanded, and with the applications of the third book intermixed. But it omits the most important part of the eleventh section: nevertheless, a student who should join with Dr. Clarke's work the article GRAVITATION in the present one, would have the most important parts of the Principia, as far as is necessary to gain an insight into Newton's methods.

In the same year, 1730, George Peter Domck published his 'Philos. Math. Newt. Illustratæ Tomi Duo, Londi[illegible] (This work is inadvertently called an edition of the Pr[illegible]cipia in NEWTON, and its author's name is spelled Donick.) The first volume of it is only a preparatory course of mathematics; the second gives a large part of the first book in Newton's manner, and gives more of the results of the eleventh section. It also enters upon some of the numerical applications of the third book.

The Commentary of the Minims (Jesuits they are usually but wrongly called) Le Sueur and Jacquier (1739) is an excellent performance for its time, considered as attempting to smooth the details of the mathematical difficulties. It uses algebra freely, but is totally insufficient to show the use of the differential calculus as now known; but it very frequently develops satisfactorily a point at which Newton only hinted.

Emerson's 'Short Comment on Newton's Principia,' 1770, is a brief explanation of some of the mathematical difficulties and obscurities, followed by defences of the Principia, the Optics, and the Chronology. Emerson defended everything of Newton's.

The popular explanations of Maclaurin, Pemberton, and Voltaire are too widely known to need description; they do not much help the mathematical student. Many so-called explanations of Newtonian philosophy (such as Benjamin Martin's, 1751) are literally nothing but treatises on general physics.

The additions to Madame du CHASTELLET's translation consist of a popular *resumé* and the mathematical treatment of various questions of the Principia. The latter must be considered as emanating from Clairaut, since they were his lessons to his pupil. Some have supposed that Voltaire's work belongs in the same sense to Madame du Chastellet.

In the 'Mécanique Céleste,' book 16, cap. 2, Laplace has exhibited the results of Newton's lunar theory, and connected them with the m[illegible]ern analysis of the subject to a certain extent. The preciseness of the manner of compressing Newton's results renders this chapter valuable, and likely to assist the student of the Principia.

Mr. Airy's development and extension of the results of the eleventh section (which forms the article GRAVITATION in this work) places one of the methods of the Principia, and one which ought to last, within the reach of every student. It is unique, the difficulties of the eleventh section having left it almost without a commentator, and altogether without an explainer; and it takes in several of the discoveries of the present time.

Many commentaries on the Principia have been written at Cambridge by private tutors for the use of their pupils, of which some have been printed. Of the following we have never seen more than the title: 'Excerpta quaedam e Princ. Phil. Nat., cum notis variorum,' Cambridge, 1765. There is Carr's three sections of Newton, a modern work, and an exposition of various parts of the Principia, contained in the second edition of Professor Whewell's 'Dynamics.'

To give a view of the foreign objections to Newton's system, at the time of its first introduction, the following works may serve: 1, 'Collection of Papers which passed between Mr. Leibnitz and Dr. Clarke, in 1715 and 1716,' by Dr. Samuel Clarke; London, 1717. 2, 'Traité de Paix entre Des Cartes et Newton,' by the Jesuit Aimé-Henri-Paulian; Avignon, 1763. 3, 'Le vrai Système de Physique générale de M. Isaac Newton, exposé et analysé en parallele avec celui de Des Cartes,' by the Jesuit Louis Castel; Paris, 1743 (a defence of Descartes). 4, 'Anti-Newtonianismus,' by Celestini Cominale, M.D.; Naples, 1754. 5, 'Discours sur les différentes Figures des Astres,' by Maupertuis, the first assertor of Newton's doctrines in France; Paris, 1739, and in the collection of his works. 6, 'Letters to a German Princess,' by Euler (first published in 1770, translated into English by Dr. H. Hunter, 1795).

The most celebrated comments in the way of objection are those of Leibnitz, John Bernoulli, and Huyghens [HUYGHENS]; the first and second real admirers of the genius of Newton, the third also an admirer after his fashion. Many of their remarks may be found in the published correspondence of the first two, but the history of the effect produced by the Principia in the years following its publication is scattered in too many places for us to attempt to give the particular publications which should be consulted.

PRINCIPLE, D'ALEMBERT'S. [FORCES, IMPRESSED AND EFFECTIVE; VIRTUAL VELOCITIES.]

PRINGLE, JOHN, the youngest son of Sir John [illegible]ingle, Bart., and Magdalen Eliott, the sister of Sir Gilbert [illegible]liott, Bart., was born at Stichell-House in Roxburghshire, April 10, 1707. Havin[illegible] received at home, under a private tutor, the elements of a classical education, he entered the university of St. Andrews, where a relative of his father, Mr. Francis Pringle, was at that time professor of Greek. After keeping the ordinary number of terms, he removed to Edinburgh, in October, 1727, in order to qualify himself for the medical profession; but in the year following he proceeded to the university of Leyden. It is stated, by Dr. Kippis, on the authority of Mr. James Boswell, that Pringle was at one time intended to follow a mercantile life, and that on leaving Edinburgh he went to Amsterdam for that purpose, but that his attention was accidentally drawn to the study of medicine by attending a lecture of Boerhaave in the university of Leyden. He entered this university in 1728, and took the degree of doctor of physic, 20th July, 1730, his diploma bearing the signatures of Boerhaave, Albinus, Gravesande, and other eminent individuals. His inaugural dissertation was entitled 'De Marcore Senili.' On quitting Leyden, he proceeded to Paris, where he completed his medical studies, after which he settled as a physician at Edinburgh. He had not however given his attention exclusively to medicine. In 1734 he was appointed by the magistrates and council of Edinburgh to the professorship of moral philosophy in the university of Edinburgh, jointly with Mr. Scott, during the life of the latter, and solely after his decease. Dr. Kippis says he was appointed to the chair of pneumatics and moral philosophy, but no mention of the former of these sciences is to be found in any other notice of Pringle's life to which we have referred. He continued to practise at Edinburgh as a physician till 1742, when he was nominated physician to the Earl of Stair, who then commanded the allied armies of England and Austria, and through whose recommendation he received the same year the further appointment of physician to the military hospital in Flanders, at a salary of 20*s*. a day, and half-pay for life. He was present at the battle of Dettingen (26th June, 1743), shortly after which he was promoted by the Duke of Cumberland, second son of George II., to be physician-general to his majesty's forces in the Low Countries, whereupon he resigned his professorship. The benevolence of his disposition and the exemplary zeal and ability with which he discharged his official duties while connected with the army, are attested by all who knew him. Impressed with the suffering frequently attendant on the sudden movement of an army, which necessitated as sudden a removal of the hospitals or the abandonment of the men to the doubtful generosity of an enemy, he applied himself earnestly to the consideration of the means whereby it might be mitigated or removed. Prior to this it had been the custom to place the sick and wounded at a distance from the army, but even then it often happened that a posi tion of salubrity was incompatible with one of safety Through his exertions a convention was entered into, in the early part of the campaign of 1743, between Lord Stai and Marshal Noailles, for the mutual protection of th hospitals of both armies. This convention was faithfull adhered to by both the French and English generals Pringle's situation afford[illegible] ample opportunity of observin the influence of climat[illegible], confined and humid quarters habits of intemperance and uncleanness, &c. These, wit the characteristics of the epidemics peculiar to armies, he carefully recorded and digested, applying himself indefatigably to the investigation of the proper modes of treatment under different circumstances. His treatise 'On the Diseases of the Army,' which appeared in 1752, and which passed through seven editions, besides being translated into the French, German, and Italian languages, was not a work from which the medical practitioner alone was capable of deriving instruction. Among other instances corroborative of its general utility, General Melville, who, while governor of the Friendly Islands, was instrumental in saving the lives of near seven hundred of his soldiers, attributed his success to the plainness of the language employed in this work and the soundness of the information which it conveyed.

Dr. Pringle was recalled from Flanders in 1745 in order to attend the army employed under the Duke of Cumberland in suppressing the Scotch rebellion. He remained with the forces till after the battle of Culloden (16th April, 1746). The year following he again accompanied the army abroad, but on the conclusion of the peace of Aix-la-Chapelle (30th April, 1748), he returned to England, after which he resided principally at London, as physician in ordinary to the Duke of Cumberland. He had been elected in 1745 a member of the Royal Society, and his communication to their published Transactions of a paper entitled 'Experiments on Septic and Anti-septic Substances, with remarks relating to their use in the theory of medicine' (1750), to which the Copley medal was awarded, added to his reputation. Empiricism indeed appears in some measure to have been looked upon by him as not only the beginning, but the end of all useful inquiry, and he not merely entertained a strong aversion to all hypothesis, but attached comparatively little value to theory even when based on experiment. Upon one of the members of the Royal Society remarking to him that it was at least neces[illegible] reason on the results of observation and experi[illegible] he is said to have replied, 'The less the better; it is by reasoning that you spoil everything.'

In 1753 he was elected one of the council of the Royal Society. In 1758, on relinquishing his appointment in the army, he was admitted a licentiate of the College of Physicians. In 1761, soon after the accession of George III., he was appointed physician to the queen's household, and in 1763 physician extraordinary to her majesty. The same year he was chosen a member of the Academy of Sciences at Haarlem, and fellow of the College of Physicians, London. In 1766 he was elected a member of the Royal Society of Sciences at Göttingen, and the same year the dignity of baronet was conferred upon him by George III. In 1772 he was elected president of the Royal Society. In 1774 he was appointed physician extraordinary to his majesty. In 1776 he became a member of the Academy of Sciences at Madrid, the Society for the Promotion of Agriculture at Amsterdam, the Academy of Medical Correspondence at Paris, and the Imperial Academy of Sciences at St. Petersburg. In 1778 he succeeded Linnæus as foreign member of the Academy of Sciences at Paris, an honour which that body has hitherto restricted to eight individuals. The same year he became foreign member of the Academy of Sciences and Belles-Lettres at Naples, and in 1781, a fellow of the then recently instituted Society of Antiquaries at Edinburgh.

As president of the Royal Society the annual presentation of the Copley medal devolved upon him, and on each of these occasions he read before the members a discourse on the history and present state of the particular science the extension of which it was the object of the medal of that year to reward. These discourses, six in number, were published the year after his death, by his friend Dr. Kippis, in one volume, 8vo.

About the year 1778 a dispute arose among the members of the Royal Society relative to the form which should be given to electrical conductors so as to render them most efficacious in protecting buildings from the destructive effects of lightning. Franklin had previously recommended the use of points, and the propriety of this recommendation had been acknowledged and sanctioned by the Society at large. But after the breaking out of the American revolution, Franklin was no longer regarded by many of the members in any other light than an enemy of England, and as such it appears to have been repugnant to their feelings to act otherwise than in disparagement of his scientific discoveries. Among this number was their patron George III., who, on its being proposed to substitute knobs instead of points, requested that Sir John Pringle would likewise advocate their introduction. The latter hinted that the laws of nature were unalterable at royal pleasure; whereupon it was intimated to him that a president of the Royal Society entertaining such an opinion ought to resign, and he resigned accordingly. This story, though it does not appear to be in print, having been suppressed in deference to royalty, was current at the time among the members of the Society, and there is no doubt of its truth. Dr. Hutton alludes to it in the following extract from his 'Mathematical Dictionary:'—'Considering the great attention that was paid by Sir John Pringle to the various and important duties of his office, and the great pains he took in the preparation of his discourses, it was natural to expect that the burthen of his honourable station should grow heavy upon him in a course of time. This burthen, though not increased by any great addition to his life, for he was only six years president, was somewhat augmented by a fall from which he received some hurt. From these circumstances some persons have affected to account for his resigning the chair. But Sir John Pringle was naturally of a strong and robust frame and constitution, and had a fair prospect of being well able to discharge the duties of his situation for many years to come, had not his spirits been broken by the most cruel harassings and baitings in his office. His resolution to quit the chair originated from the disputes introduced into the Society concerning the question whether pointed or blunt electrical conductors were the more efficacious, and from the cruel circumstances attending those disputes. These drove him from the chair. Such of those circumstances as were open and manifest to every one were even of themselves perhaps quite sufficient to drive him to that resolution. But there were yet others of a more private nature which operated still more powerfully and directly to produce that event, which may probably be hereafter laid before the public.'

In 1781 he disposed of his house in Pall Mall, and the greater part of his library, and removed to Edinburgh, where he purposed residing permanently, but the rigour of the climate, the state of his health, and a restlessness of spirits induced him to return to the metropolis the same year. On quitting Edinburgh he presented the College of Medicine in that city with three manuscript volumes in folio, on the condition that they should neither be suffered to leave the college nor to be printed. He died January 18, 1782. His remains were interred in St. James's church, with great funeral solemnity, and a monument, by Nollekins, at his nephew's expense, was some time after erected to his memory in Westminster Abbey. A list of his published works is given in Watt's 'Bibliotheca Britannica,' and under the article 'Sir John Pringle,' in Brewster's 'Cyclopædia.' They are not numerous, and, with the exception of those already mentioned, they no longer possess much interest. The circle of his correspondents included the most eminent men of science in Europe, more particularly those of France, Germany, and Holland, with whom he kept up an active intercourse both by letter and by the attention and hospitality he showed them during their visits to the metropolis, but the extent and interest of his epistolary correspondence can be but imperfectly judged of, owing to the circumstance of his having ordered the whole of his letters to be destroyed a short time before his decease.

(*Life of Sir John Pringle*, by Andrew Kippis, D.D., prefixed to Sir John Pringle's Six Discourses above referred to: *Eloge de M. Pringle*, by Condorcet, *Œuvres Complètes*, tom. ii., pp. 226-247.)

PRI'NIA, Dr. Horsfield's name for a genus of birds first defined in *Linn. Trans.*, vol. xiii., and figured and described in the Doctor's *Zoological Researches in Java*.

Generic Character.—Bill rather lengthened, much compressed, entire; rictus smooth, wings rounded, tail broad and cuneate; feet large, strong. (Sw.)

Example, *Prinia familiaris*.

Description.—Dark brown above with a faint tint of orange. The throat and neck anteriorly are white, and the breast and abdomen pale sulphureous yellow. The wings crossed transversely in an oblique direction, with two white bands. Tail-feathers, except the two intermediate ones, marked near the end with a broad band of blackish brown, tips dirty white. Intermediate tail-feathers brownish throughout underneath, and, near the extremity an almost imperceptible transverse band of a deeper hue. Tarsi yellowish. Bill corneous brown above and at the point; its base pale yellow.

This is the *Prinja* of the Javanese, *Familiar Creeper* of Latham.

Locality, Habits, &c.—Abundant in many parts of Java, near villages and gardens, in the confines of which, among trees and shrubs, it builds its nest. It is a sprightly bird, sporting among the branches in short and rapid flights, and has received its native name from its lively and pleasant notes. (Horsf.)

Mr. Swainson (*Classification of Birds*) thinks that *Prinia* may be a subordinate type or subgenus of *Drymoica*. [SYLVIADÆ.] He observes that the *Priniæ* have all the activity and familiarity of the true Wrens (*Troglodytes*), and so much resemble them in general appearance, in their short sweet song, and the throwing up of the tail, that it is not very surprising that they should have been classed with the scansorial creepers.

Prinia familiaris.

*** In the article PLOVERS, *Himantopus Melanogaster* is erroneously printed under the cut instead of *Himantopus Melanopterus*, as well as in four places in the adjoining columns. The reader is requested to substitute '*melanopterus*' for '*melanogaster*,' in each of these cases.

PRINSEP, JAMES, was descended from a family of Swiss extraction which had been some time settled in England. He was born in the year 1800, and went out to the East Indies at an early age in the service of the East India Company in the Mint department. On his arrival in India he was appointed assaymaster at Benares, where he remained about ten years. Here he collected the materials of his 'Sketches of Benares,' which perhaps give some of the best representations of Indian life yet published. He planned and constructed many works of public utility, and engaged in a valuable series of statistical inquiries connected with Benares. At this time he wrote an elaborate memoir on the mode of determining accurately the point at which the precious metals fuse, which was published in the 'Philosophical Transactions.' Subsequently he was elected a Fellow of the Royal Society.

When the Benares mint was abolished, Prinsep was transferred to that at Calcutta. He had previously contributed to the 'Gleanings of Science,' conducted by Capt. Herbert, and on the departure of that gentleman from Calcutta he became the secretary to the physical class of the Asiatic Society, and editor of the 'Gleanings,' which he remodelled in 1832, under the title of the 'Journal of the Asiatic Society,' a work which has contributed in an eminent degree to the extension of every species of information in India. His attention having been directed to the subject of Bactrian coins, he made numerous discoveries which enabled him to fill up the blank left in the history of the successors of Alexander the Great in Bactria, and constructed a nearly unbroken series of numismatic records, which extended from the Macedonian king to modern times.

On the departure of H. H. Wilson for England in 1832, he became secretary to the Asiatic Society, and he now began to follow in the steps of Jones, Colebrooke, and Wilson, in the field of Indian antiquities. Meantime his labours as editor of the 'Journal' were unabated; he was in a great measure the engraver and lithographer for it; and he carried on an extensive correspondence in India and with Europe, besides contributing a number of valuable articles on a great variety of subjects, especially chemistry, mineralogy, Indian numismatics, and Indian antiquities. The most interesting of his discoveries is the deciphering of inscriptions which had remained a sealed book to all previous Orientalists, and which are important as connecting the history of India with that of Europe: the name of Antiochus the Great and the mention of his generals as commanding in the north of India, occur in two edicts of Asoka, or Piyadasi, king of India.

Under the weight of these and other labours his health began to break down. It was hoped that a voyage to England would restore him; but after an illness of eighteen months, he died, on the 22nd of April, 1840, in the 40th year of his age. His case is said to have borne a considerable resemblance to that of Sir Walter Scott. His death has left a blank in the progress of knowledge and civilization in India which will not perhaps be readily filled up.

(*Delhi Gazette*, July 8, 1840; *Proc. Roy. As. Soc.*, 1840.)

PRINSE'PIA, a genus of plants of the natural family of Chrysobalaneæ, so named by Dr. Royle in honour of James Prinsep, the late distinguished secretary of the Asiatic Society of Calcutta, in consequence of his contributing, by his researches into the meteorology of India, to the progress and right understanding of the geography of plants, an important branch of botany. The genus consists of only a single species, remarkable for its thorny appearance, but it may be considered typical of the labours of the individual whom it is designed to commemorate, as [illegible] in the season, it is conspicuous for the abundance of [illegible] florescence, and, later, for that of the purple-coloured [illegible] with which it is loaded. The seeds are large, and yield by expression an oil which is highly esteemed by the mountaineers of the Himalayas, where it is indigenous, and which by Europeans is thought a good substitute for salad oil.

PRINTING, in the widest sense of the word, may be defined to be the art of producing copies of any writing or other marks by pressure, either upon a substance so soft as (like wax or clay) to take the shape, whether in relief or by indentation, of the stamp applied to it, and yet not so perfectly fluid (like water) as to refuse to retain the form so given to it, or upon a substance sufficiently bibulous or otherwise attractive as to receive colour from some pigment with which the stamp is daubed. The essence of printing is the production of a copy by pressure. Correctly speaking however it is not an exact copy or fac-simile which printing produces in any case; so far from that, wherever the surface is raised in the stamp, it is sunk in the impression, and *vice versâ*, and even a merely coloured mark is always reversed in form; but, what is alone of importance, all the impressions are exact copies of one another, and also bear a certain and perfectly assignable relation to the stamp or type.

Even on a theoretical view of the subject, printing by means of merely a variegated surface of stamp, or, in other words, the reproduction, in soft substances, of cameos and intaglios, would seem to be the simpler and more obvious of the two kinds of printing we have mentioned. This may be said to be printing by pressure alone. In the other kind of printing, by the transference of colour, there is required the introduction, in addition to the type and its recipient, of a third element or agent, namely, the colour to be transferred. And this was an addition very little likely ever to be made until the idea of multiplying copies of coloured marks had itself occurred, that is, until the very object had been thought of which this was the only means of accomplishing, and which was the only object this process was suited to accomplish. Having a seal or cut stamp in his hand, the making an impression with that upon wax or any other soft substance was extremely natural for a person wishing on any occasion to leave his mark or sign; it was the same thing, in fact, with notching a piece of wood or stone with a knife or other sharp instrument, with this difference only—that the knife makes its marks by excision, or altogether removing and abstracting part of the substance operated upon; the stamp, by extrusion, or merely pushing it aside. Or still more nearly it resembles the rudest and rudest of all ways of making a mark, namely, by dealing a blow. But it is a mode of making a mark only; that is its sole purpose and object. There is no thought, so long as this kind of printing exclusively is used, of multiplying copies of the same mark; that is an idea [illegible] removed from the first and most natural employment of a dry stamp or seal, and not perhaps more likely to be suggested by such stamp-[illegible] capable of being so realised) than by some other things—by the mere common process, for instance, of copying by imitation. If a transcriber had ever had before him a written page, with the ink not yet dry, which he was laboriously reproducing with his pen, the slowness of his procedure, especially if he were pursued by an active and growing demand on the part of the public for books, might have led him to the thought of the possibility of performing the whole task in a manner at once, by merely impressing the wet writing upon the blank paper, and then re-transferring it from the reversed copy thus made to another sheet, in order to recover the original position of the characters. And if by any means the reversed copy could be kept moist, or its moisture repeatedly renewed, here was a method of procuring in the same easy manner an indefinite number of copies. The mechanical facilities were still to be invented, but this was the elementary idea of what we have been regarding as the second kind of printing; which, it thus appears to us, would probably not be suggested by the first kind at all, but rather by the desire of effecting an object (namely, the multiplying of copies) altogether different from that (namely, the mere making of a mark) which was the primary purpose of a dry stamp or seal, and only presenting itself at a much later and more advanced stage in the progress of civilization.

These considerations may help to account for the historic fact that the use of engraved seals for impressing soft substances preceded by so many centuries the invention of the art of printing by the transference of a pigment, or, in other words, by means of coloured stamps or types. Of the great antiquity of seals for making marks with, we have abundant evidence. Seals and signets are repeatedly mentioned in the Jewish scriptures, and, we know, were in common use among all the civilised nations of antiquity. If the idea of multiplying copies of books or writings had chanced to occur in combination with that of this employment of dry seals, it might no doubt have produced an invention serving the same purpose with our modern printing, but in that case the first printing would probably have been that indented or embossed kind which has been lately introduced for the use of the blind. After that had been practised for some time, ingenuity or accident would have suggested the introduction of a pigment for the purpose of making the indentations more distinctly visible; and from that to the omission of the indentations altogether would have been apparently an easy and obvious step, though it might have happened here too, as in many other cases, that all the advantages of the new process would not be at once perceived, and a part of the old method, the utility of which it had really superseded, would nevertheless for a considerable time continue to be practised as before. But the fact, as we have said, appears to be that the art of printing did not take its rise in this way at all, but from the combination of the idea of multiplying copies of books with the other idea of the possibility of taking off an impression from a page of writing while yet wet by the simple act of applying to it another flat surface to receive a portion of the ink or other pigment. We say, applying the receiving substance to the writing; for even in this point of detail the process would probably differ altogether from the common mode of using a seal, which is impressed upon the receiving substance, not that upon it.

Nevertheless the principle of an engraved or uneven surface might still for a particular purpose be called in to the aid of the process of pigment-printing, although it had nothing to do with the suggesting of that process. Suppose the writing which is to be transferred by such mode of printing to be traced in visible black characters upon a smooth surface of wood or metal, how is the pigment to be most conveniently renewed every time it gets dry or faint? With an even surface it is evident that this could only be done by the tedious method of retracing every line of the writing with a pen or brush; a method which—besides its consumption of time, making printing, in fact, as slow as writing—would probably be found to be inefficient, as leaving the page dry or half dry in one part before it could be inked over in another. But by either cutting hollows for the ink, or causing the characters to stand out in relief, the great advantage is gained of being able to spread the pigment by a few sweeps of the brush along every line which it ought to colour, without leaving any of it upon the intervening parts of the wood or metal: in the case of hollow lines being cut (as in copperplate-printing), the ink that is spread in the first instance over the whole surface is easily wiped away from the rest without being taken out of the hollows.

At this point then we may be said to have at last obtained the art of printing in a practical shape. The art was now invented. This is precisely the art of printing as it has been known in China since the middle of the tenth century, when it is said to have been discovered by a minister of state named Foong-taon, and as it is still practised there. The page of writing to be multiplied is pasted down upon the smooth surface of a prepared block, commonly of pear-tree, on which it leaves an impression of the characters in an inverted form, and then the block thus marked is made ready for being printed from by all the blank parts of the face of the wood being cut away, and the lines forming the characters being thus left in relief, so as alone to receive the ink every time the brush is applied.

In such a language as the Chinese, which is without an alphabet, or, at least, in which the elementary characters have not been reduced to the same limited and commodious number as in most other languages by making them represent sounds instead of ideas or things, this is the only kind of printing that is generally applicable. The subsequent improvements or extensions of the principle of the invention are all dependent upon the common alphabetic mode of writing.

Even in Europe however, although the mode of writing was alphabetic, it was the Chinese mode of printing that was first practised. Some have even supposed that the knowledge of the art was originally obtained from the Chinese; and indeed, besides what other less direct communication there may have been, Marco Polo, who returned from China about the end of the thirteenth century, had seen and described at least one application of the invention in that country, the fabrication of a species of paper-money by stamping it with a seal coloured with cinnabar (vermillion). But, as far as we can trace, it was not till fully a century after this that even this simplest kind of printing began to be practised in Europe. It appears to have been first applied to the fabrication of playing-cards and manuals of popular devotion, the latter for the most part consisting, like the cards, of merely a single page, though in some instances assuming the form of little books of several pages. It is believed that about the year 1400, or soon after, both these articles, which had previously been manufactured by hand, and each copy of course by a separate operation, began to be multiplied, like the Chinese paper-money, from engraved blocks or stamps. There is no record of this innovation, but the fact is inferred from the perfect similarity of several copies of the same page, which could only have been produced by their having all been impressions from a common original. The playing-cards thus fabricated are merely pictures; but many of the devotional manuals, besides pictures, which in these also fill the greater part of each page, present short texts from scripture, and other examples of engraved letters and words. It is evident however that the essence of the new art is as much in [illegible]tures as in the legends, which are only pictures of another kind.

The æra of these block prints and books, as they are called, may be stated to be the first half of the fifteenth century: one in Lord Spencer's collection bears the date of 1423, and there is reason to believe that other specimens were executed almost as late as 1450. Of the block-books of any considerable magnitude the two most remarkable are the 'Biblia Pauperum,' a small folio of forty leaves, each containing a picture, with a text of scripture, or some other illustrative sentence under it, which is supposed to have been produced some time between 1430 and 1450; and the 'Speculum Humanæ Salvationis,' consisting of sixty-three leaves of the same small folio size, containing in all fifty-eight pictures, with two lines of Latin rhyme under each. With regard to this last in particular however there has been a great deal of disputation, some denying altogether its claim to be reckoned a specimen of block-printing, in so far as the legends are concerned; but it is now generally admitted that at least some of the legends have every appearance of having been printed from the same block with the picture, although in other cases they seem to have been subsequently inserted from moveable types. The probability is that at first the 'Speculum' was entirely a block-book, but that in subsequent editions the block-printing was mixed with printing from moveable types: the few copies that have come down to modern times are perhaps made up of leaves collected from several impressions, some in which moveable types were and others in which they were not used. Like the 'Biblia Pauperum,' it has no date; but it is generally admitted to have in all probability been first printed before 1440. Another block-book that was frequently printed, and which is noticeable as consisting wholly of text, without pictures, was the small Latin Grammar of Donatus, the common school-book of these days. These block-books are, like the Chinese books at this day, printed only on one side of the leaf; and they appear to have all been produced in the Low Countries.

At this point, as we have already observed, printing would have stopped, if the art of alphabetic writing had remained undiscovered. At most, the art could not have been carried beyond what has been called logography, or the printing with types each containing a whole word, a method which is in partial use in China, and has even in recent times been attempted among ourselves, but which is manifestly of very limited application. Logography, indeed, is merely a modification of block-printing; the principle is the same whether the block or type contain a whole word, a whole line, a whole sentence, or a whole page.

It is not unlikely however that the partial employment of logography in the infancy of European printing may have been what suggested alphabetic printing. There is good evidence that some words of common occurrence were early cut out on separate stamps or types; and although this may have been done only after the invention of alphabetic printing, to save the trouble of composition (or setting up the words from the letters), it is possible that the same thing may also have been done while only block-printing was known, with the view of saving the repeated cutting out of the same words. If so, the perception, thus awakened and turned to account, of the fact that two different pages often contained some words in common, would be apt, it may be thought, to conduct to the reflection that all words and all pages that could be printed were composed out of the same twenty-four letters, and that therefore if a sufficient number of types consisting each of a single letter could be provided, the same types that had been made use of in printing any one page might, with the mere trouble of re-arrangement, be made to serve for printing any other. Here was what we may call quite a new principle. Logography was indeed the employment to a certain extent of moveable types; but the principle of moveable type printing was no more there than we can say the principle of alphabetic writing is to be found in the 214 radical characters of the Chinese. The universality which is the essence of a principle is equally wanting in both cases.

Yet, whether it may have been arrived at through the medium of logography or not, it may be safely affirmed that, where alphabetic writing was known, alphabetic printing could not be long in being found out. It was in fact in a manner already invented, in the co-existence of pigment printing on the one hand, and of alphabetic writing on the other; for it was the mere resultant, without the assistance of [illegible] third element, of the combination of these two ideas. Not that even this simple combination would of necessity be immediately made; the history of discovery sufficiently attests that it will often be a considerable time before a third thing is thought of which would be at once accomplished by the mere bringing together, and into simultaneous and accordant action, of two things already familiarly known and practised; but still, fortuitously or through reflection and experiment, the new idea is much more likely to be struck out in these circumstances than if a more complex combination were required to produce it, and, especially where the state of society supplies any considerable stimulus to the attainment of it, cannot be very long in being arrived at.

The common art of printing, in essentially the same degree of completeness in which we now possess it, had certainly been discovered before the middle of the fifteenth century; but when, where, and by whom each successive improvement of the original pigment-printing by means of engraved blocks was discovered and first put in practice is not so easily settled. The employment of moveable types, the production of such types by the process of casting them in metal, and the formation of the matrix, or mould, by means of the punch, or stamp of hardened steel, by which the matrix is impressed or hollowed out; these, disregarding mere mechanical facilitations, may be considered as the three great organic revolutions by which block-printing was transformed into the art as it now exists. They are far, indeed, from being upon a level in point of importance; they descend in value in the order in which we have enumerated them, which must also have been the order in which they followed each other; and the third contributes so little to the completion of the invention, as compared with either the first or second, that we might perhaps without much injustice omit it altogether. Yet, strictly considered, it too has the same characteristic with the others of converting a process of mere imitative copying into one of what we may call identical reproduction, or, in other words, substituting the unity of a single mechanical operation for a succession of separate manipulations. The invention of printing may be said to be, in all its parts, distinguished from mere writing by this very characteristic; this is throughout its principle, and that in which it consists; in block-printing, the page, having been once cut out upon the wood, is afterwards reproduced by a single touch of the inking-brush as perfectly as it could be by retracing every line of every letter with the pen; by the employment of moveable types, the same letters which have already served to print one book are made to print any other, without a new cutting, however new the matter, or any further trouble except a re-arrangement of them; by the art of founding or casting the types in metal, the separate fabrication of every single type is done away with, and any number of types of the same character are obtained by merely dropping the metal into the matrix; and, finally, by the contrivance of the punch, matrices themselves are thus mechanically multiplied as well as types. Pigment stamping, the breaking up of the block-page into single letters, the substitution of letters of cast metal for those of cut wood, and the production of many matrices from one punch, the four successive steps constituting the invention of printing, have thus all one end and aim. This very circumstance might enable one of them in a great measure to suggest another.

Simple as the first of the four successive discoveries—stamping or printing with a pigment—may be thought, it was perhaps both the most important and the most difficult to achieve of the whole. Even if the art of printing had never been carried farther than the Chinese have carried it, how precious a gift of heaven would it not still have been! how incalculably would it not have elevated the function of written language! Indeed that primitive sort of printing would have been all-sufficient, and in every respect the best, in all those numerous instances in which stereotyping (essentially the same thing) is now resorted to, even in countries possessing an alphabet; and a time perhaps is coming when in all countries the increase in the number of readers may make that kind of printing the kind most employed, as it probably would be in China from that cause alone, even did the nature of the written language admit of the employment of moveable types. The idea of producing an impression by a coloured stamp would seem also to have lain very remote from ordinary operations and habits of thought; men had been using dry seals from the earliest times of Eastern civilization, but we find no trace of this other kind of stamping, at least for the purpose of multiplying writing, even in the East, till about nine centuries ago, and none in Europe till five hundred years later. Neither Egypt, nor Greece, nor Rome, had thought of this, with all their ingenuity, and among all their arts. He therefore, we may say, was truly a great genius who first meditatively conceived the notion of making an engraved seal or block thus roduce a permanent impression of itself upon a hard surce by merely besmearing it with a little colouring matter simplest of all simple operations as that seems, now that we are familiar with it, and must have seemed indeed as soon as it had been even once performed.

As for the three subsequent improvements, which constitute the whole portion of the art of printing indisputably invented in Europe in the fifteenth century, and to which alone the claims of the several individuals to whom the invention has been attributed have any reference, even the chief of them, the substitution of types containing each a single letter for blocks containing an entire page, must, we apprehend, be considered as inferior to the primary

Chinese discovery in novelty, or real originality of conception, as it undoubtedly is in importance. That wonderful instrument, the alphabet, being already invented, this improvement consisted merely in chopping down the engraved wooden block into as many separate pieces as there were letters cut upon it. The first time that a school-alphabet was printed by block, the thing was in a manner done; here stood the twenty-four letters already separated to the eye, and in all respects, except in so far as regarded the material cohesion of the wood; and actually to part them was no more than what is done by every child who finds himself in possession of a similar alphabet embossed upon a cake of gingerbread. Probably this was done in the first instance without any forethought of their recomposition in a new order; so that there may have been moveable types before moveable-type printing was dreamed of, and the latter may have been suggested by the former. But at any rate, an innovation the idea of which consisted simply in supposing the arrangement in a different order of a number of objects already visibly unconnected, or separable, must in one way or another have been speedily brought about. The casting of metal types again was only an application of the art of founding, which is one of the most antient of the arts practised by men; and the fabrication of the matrix by a punch was merely an example of the familiar practice of receiving the impression of a stamp or seal upon a substance softer than itself, and precisely the same thing with the very common mode of stamping coins by hammering.

Four names have principally figured in the controversy that has been raised about the invention of printing:—John Gutenberg (paternally Gensfleish), of Strasburg; John Fust (or Faust), of Mayence; Peter Schoeffer (in Latin, Opilio), of Gernsheim; and Lawrence Coster (or Janszoon), of Haarlem. The pretensions of John Mentelius, of Strasburg, need scarcely be noticed. In addition to the accounts which will be found under these names, we shall here subjoin a summary of what appears to be the most probable state of the facts, and the version of the matter that is now generally received.

With regard to the tradition recorded by Hadrian Junius, which ascribes the invention of printing to Coster [COSTER], it may be remarked that, whatever may be thought of the external evidence for the story, the account of the invention with which it supplies us is in the highest degree improbable. The date assigned to Coster's experiments cannot, by any straining of Junius's meaning, be carried farther back than the year 1440. We know that long before that time block-printing, both of pictures and of words, was in common use; yet the Haarlem churchwarden is represented as no more indebted for his new idea to that process than if he had never heard of its existence; that is to say, nine-tenths of the whole art of printing being already discovered and in use, this singular genius discovers the remaining tenth, not by availing himself of what had been already done, but by beginning from the beginning in a way of his own, and most unnecessarily discovering the whole over again. Coster must have seen block-pictures and block-books, but these do not afford him a hint; he takes his whole notion of printing from having been accidentally led to cut out some letters in the bark of trees; the letters already properly reversed on the blocks, and actually employed for making impressions, teach him nothing, suggest nothing to him; but he is filled with the idea of the whole process of printing, in its most improved form, including moveable types, by his own carvings in the bark, which really could have no more tendency to suggest any part of the idea than any other characters graven on wood, or stone, or metal, he had ever looked upon, or even than the common writing in a book. Of course, when Coster, in his afternoon walks, made, like Orlando in the play, the trees his books, and charactered his thoughts in their barks, he cut his letters so as that they should present the usual appearance to the eye; if he reversed them, then it was not his operations on the bark that gave him the idea of printing, but the idea of printing previously acquired, and elsewhere derived, that set him to operate on the bark. But the truth is that the maker of this story misapprehended altogether in what it is that the invention of the art of printing consisted; it did not consist in conceiving the employment of inverted characters—that was quite a familiar expedient, as old as the coining of money or the use of seals, things which had been known for thousands of years; what it consisted in was the application of a pigment to the stamp or seal in a manner which this stupid story about Coster takes no notice of whatever. The probability is, that Coster was one of the early block-printers, whose art, there is every reason to believe, was first practised in Holland. If this art could be proved to have been really invented there, whether by Coster (whose date however is scarcely antient enough) or by some other of his countrymen, and not borrowed from the Chinese, the Dutch would be then entitled to take to themselves the glory of being the true discoverers of printing, and would have little reason to grudge their German neighbours all that they claim as its improvers and perfecters by having been the first to employ moveable types, and matrices, and punches.

These mere improvements are all that can be attributed to Gutenberg, Fust, and Schoeffer. Gutenberg, it is now generally supposed, first began to print at Strasburg some time between the years 1436 and 1442. If what he first practised was block-printing, as has been asserted, he was not the inventor of that method, which we know was in use some years before the earliest of these dates. But there is good reason for believing that before he left Strasburg he had begun to print with moveable types of wood. Having then established himself in Mayence, which was his native town, he there, in the year 1445, entered into partnership with Fust, who seems not only to have supplied the capital for carrying on the business, but also to have assisted Gutenberg in devising or carrying into effect his subsequent great improvement of the art, by casting the types of metal. But to Schoeffer, who was in the service of Gutenberg and Fust, and had married Fust's daughter, is assigned the credit of having facilitated and (as far as the principle was concerned) brought to perfection the process of founding by the contrivance of the punch. This is the account of the matter at once most accordant with the words of the only contemporary or nearly contemporary authority, the abbot John Trithemius, in his 'Annales Monasterii Hirsaugiensis,' and best supported by all the facts that have since come to light. Trithemius, who died in 1516 (though his work was not printed till 1690, 2 vols. folio, Monast. S. Galli), professes to have derived his information from a grandson of Schoeffer. It is observable that he expressly attributes the invention of the art to Fust as well as to Gutenberg.

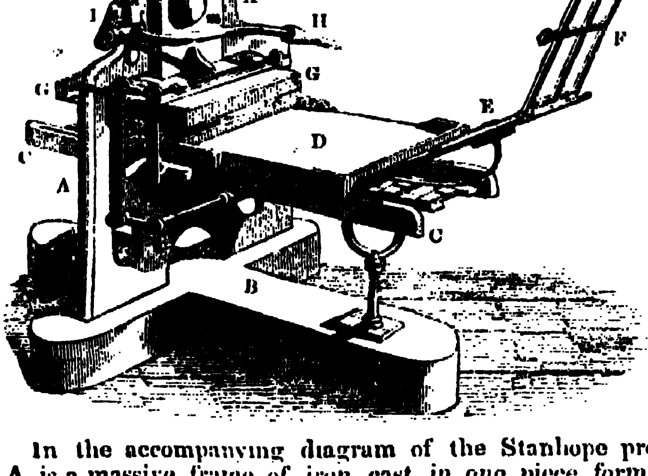
An antient chronicle, first printed at Cologne in 1474 ('Chronica, sive Fasciculus Temporum,' &c., commonly called the 'Cologne Chronicle'), notes that, after ten years had been spent in preparation, the art of printing began to be practised (cœptum est imprimi) in the year 1450. The first book, this chronicle proceeds to state, that was printed was the Bible. Trithemius informs us that before the first twelve sheets of this Bible were printed, Gutenberg and Fust had incurred an expenditure of four thousand florins. The Bible in question is the edition of the Latin Vulgate commonly known by the name of the 'Mazarin Bible,' from a copy of it having been discovered about the middle of the last century in the 'Bibliothéque Mazarine,' (ou du Collège des Quatre Nations) by the bookseller De Bure, who has given a minute description of it in his 'Bibliographie Instructive' (vol. i., pp. 32-40). Many other copies of the book however have since turned up. It is without either date or printer's name, but it appears to have been completed before 1455. For some time the new art is said to have been kept secret, and a story is commonly told of the copies of this very edition of the Bible having been sold for several years at Paris as manuscripts, but this anecdote is neither very probable nor very well authenticated. Gutenberg, Fust, and Schoeffer appear to have printed in partnership till the year 1458, when Gutenberg quarrelled with the other two, who then carried on the business by themselves while he set up a new press, also in Mayence. The knowledge of the art was first made public and carried into other countries by the dispersion of many of the workmen on the storming of Mayence by Adolphus of Nassau, in 1462. Printing was first practised in Italy, in the town of Subiaco, in the Roman territory, in 1465; in France, at Paris, in 1469; in England, at Westminster, in 1474; and in Spain, at Barcelona, in 1475. It is said that by the year 1530 there were already about 200 printing-presses in Europe.

Among the principal works upon the invention and history of printing, are—Bern. à Malinkrot, 'De Ortu et Progressu Artis Typographicæ,' 4to., Colon. Agrip., 1639; Jac. Mentelii 'De Typographiæ Origine Parænesis,' 4to., Paris, 1650 (this is an assertion of the claim of the author's ancestor of the same name); J. de la Caille, 'Histoire de l'*Imprimerie,*' 4to., Paris, 1689; And. Chevillier, 'L'Origine de l'Imprimerie de Paris,' 4to., Paris, 1694; Fra. Pellegrino Antonio Orlandi, 'Origine e Progressi della Stampa,' 4to., Bologna, 1722; Jo. Ch. Wolfii 'Monumenta Typographica,' 2 tom., 8vo., Hamb., 1740; Pros. Marchand, 'Histoire de l'Origine et des Progrès de l'Imprimerie, 4to., La Haye, 1740; Mich. Maittaire, 'Annales Typographicæ,' 5 tom., 4to., Hag. Com., Amstel., et Lon., 1719-1741; P. S. Fournier, 'Dissertation sur l'Origine de l'Imprimerie,' 8vo., Paris, 1759; Jo. Dan. Schœpflini 'Vindiciæ Typographicæ,' 4to., Argentor., 1760; Gerardi Meerman, 'Origines Typographicæ,' 2 tom., 4to., Hag. Com., 1765; Ch. Hen. Baron Heinecken, 'Idée Générale d'une Collection complete d'Estampes,' 8vo., Leips., 1771; Pi. Lambinet, 'Recherches sur l'Origine de l'Imprimerie,' 8vo., 1798, and 2 tomes, 8vo., 1810; Singer's 'Researches into the History of Playing-Cards;' Ottley's 'History of Engraving;' Fried. Metz, 'Geschichte des Buchhandels und der Buchdruckerkunst,' Darmstadt, 1834; Falckenstein, 'Entstehung und Ausbildung der Buchdruckerkunst,' Leips. (announced as about to appear in a valuable paper on the 'History of the Book-trade of Germany,' by M. Henry Meidinger, published in the 'Quarterly Journal of the Statistical Society of London' for July, 1840 (vol. iii., part 2, pp. 161-190).

PRINTING-PRESS. The term printing-press is applied to the machine used for letter-press printing or copper-plate printing, but more usually the former. The date of the invention of the printing-press is unknown, but some contrivance for this purpose must have been used as soon as printing by blocks or types was introduced. The increased force requisite to make an impression, the size of the surface to be printed from being increased, would soon suggest recourse to some of the simple machines or mechanical powers for the modification of the power requisite to obtain the necessary pressure. The screw, as applied in the common screw-press [SCREW-PRESS], would obviously suggest itself; and accordingly, in all the earlier printing-presses, the screw alone is used.

The operations to be performed in the process of printing will point out the essential parts of a printing-press. The types, being set up and arranged in a form of suitable dimensions, have to be inked; this is effected by passing across them a cylinder, or roller, covered with an elastic composition of molasses, glue, and tar. The paper to be printed has to be laid on the types when inked, and then the requisite pressure for making the impression has to be applied.

The earliest form of printing-press very closely resembled the common screw-press, as the cheese or napkin press, with some contrivance for running the form of types, when inked, under the pressure, and back again when the impression was made. This rude and inconvenient form of press was superseded by the invention of Blew, a printer of Amsterdam. Other improvements were from time to time introduced; but they were all superseded, about the commencement of the present century, by an invention of Lord Stanhope.



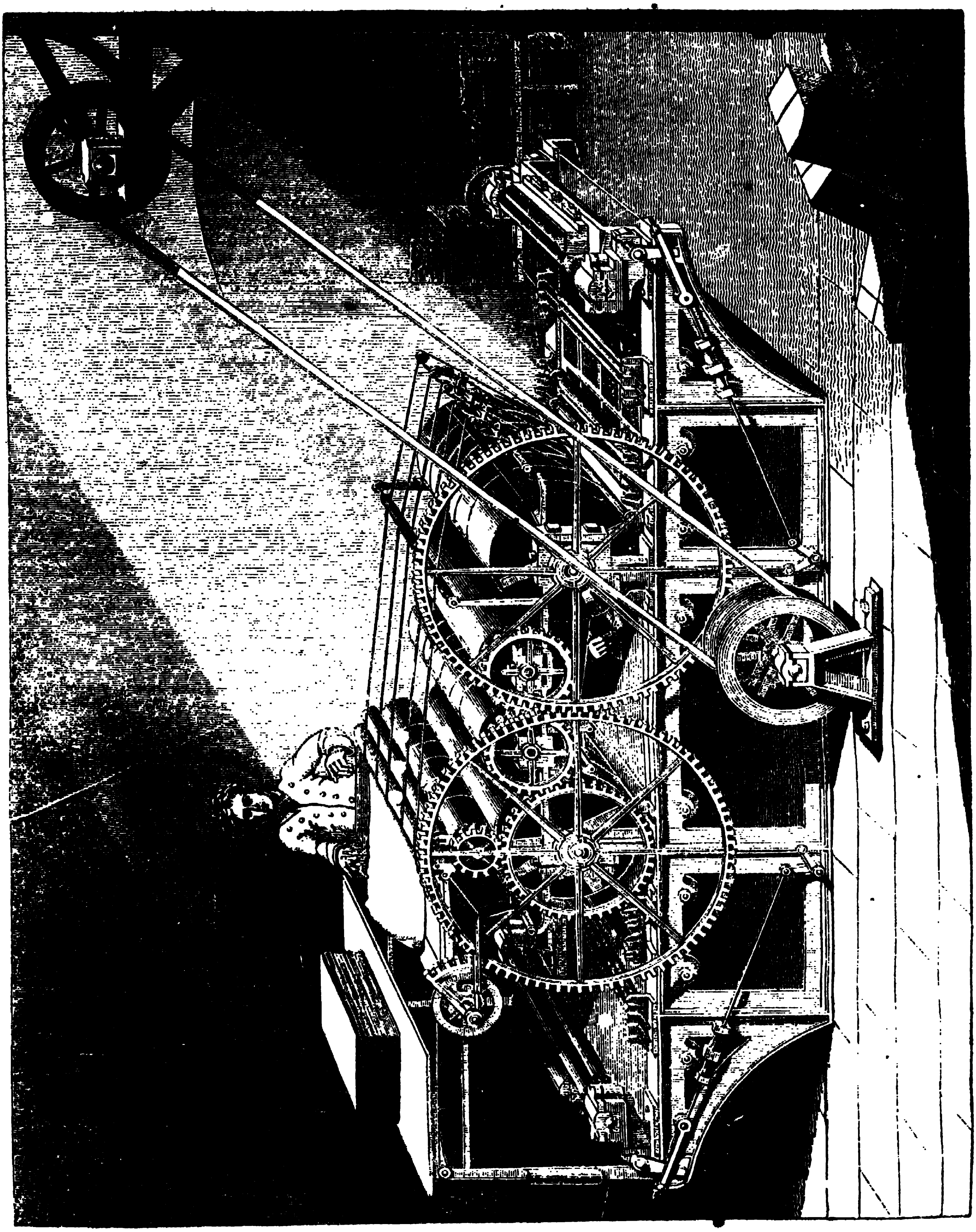
In the accompanying diagram of the Stanhope press, A is a massive frame of iron, cast in one piece, forming the body of the press, and firmly fixed to the cross B, or wooden foundation. The table C carries the form of types D, which, being placed on a carriage, traverses the table backwards and forwards, motion being given to it by means of the crank-handle acting underneath the table. To the carriage are attached the tympans E, which are light frames covered with parchment, and so constructed that the inner tympan just lies within the outer tympan. Some blanketing is placed between the tympans, so as to equalise the pressure upon the surface of the types. To the outer tympan is attached the frisket F. The sheet of paper to be printed being placed on the tympans, the frisket is turned down upon it; and then the frisket and tympans are turned down upon the form of types. The frisket is covered with paper or parchment, cut out so that the sheet to be printed, when placed between the tympans and frisket, and folded down together on the form of the types, may be in contact with the surface of the types; while the remainder of the frisket-sheet preserves the margin from being soiled.

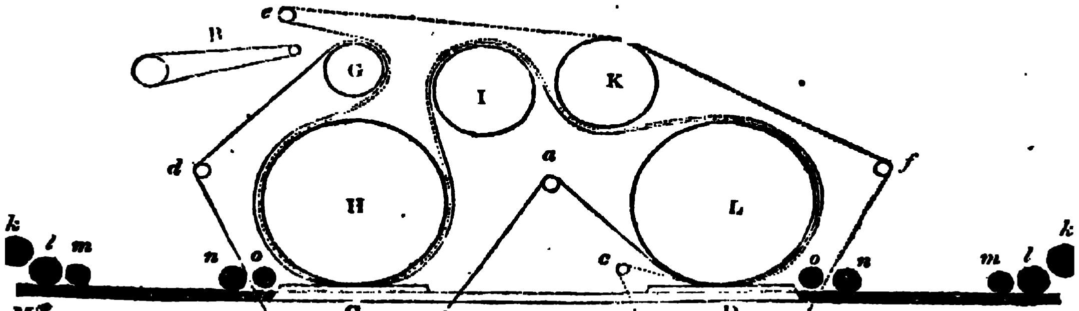
The form of types being inked, and the tympans and frisket, with the sheet of paper between them, folded down on the form, the whole is run, by turning the crank-handle, under the plattin G, which is a massive plate of cast-iron, moveable up and down perpendicularly, its weight being rather more than counterbalanced by the weight I at the back. The pressman pulls the handle of the bar H towards him, or across the press, and thus communicates motion to *k* and *l*, and causes the spindle *m*, which sustains the plattin, to descend and produce the requisite pressure. The principal improvement of the Stanhope press consists in the manner in which the descending motion is given to the screw. This depends on the properties of the bent lever, and may be explained in the following manner:—It is a necessary consequence of the peculiar combination and arrangement of the bent lever here employed, that on the handle H being moved, the plattin descends rapidly at first; but as the plattin comes very near to the extreme point of its descent, the motion is extremely slow. But at this instant the plattin is pressing the paper upon the types, and the pressure exerted being inversely as the rate of the descent of the plattin, whose motion at this instant is exceedingly slow, the pressure produced is enormously large. It will be found also that at the instant the plattin is at its lowest point, the connecting bar *l*, by which the power applied is transmitted to the plattin, passes across the centres of motion of the system of forces; and at this instant, as theory points out, the ratio of the pressure produced to the power applied is indefinitely large. The pull having been made, or the pressure produced, the handle H returns to its original position, being taken back by the weight I at the back, which rather more than counterbalances the plattin. The carriage is then run back, the frisket and tympans unfolded, and the printed sheet being taken out, the same operation is repeated. The usual rate of printing by the Stanhope press is two hundred and fifty per hour, two men being employed, one to ink the types, and the other as pressman.

The principle of the Stanhope press has been followed out by several subsequent inventors, and improvements of mechanical detail introduced, tending to the economy of time and labour, and to precision of workmanship. In the Ruthven press, the form of types remains stationary, and the plattin is removed to permit the types to be inked; and in this, as well as the Columbian, the pressure is produced by a combination of levers alone, without the use of any portion of a screw or inclined plane.

The press for copper-plate printing consists of two cylinders, or rollers, of wood, supported in a strong wooden frame, and moveable about their axes, one placed just above and another just below the level of the table upon which the plate to be printed is laid. The upper roller is turned round by the arms of a cross fixed to its axis. The copper-plate being inked, the paper on which the impression is to be taken, and two or three folds of soft material, as blanketing, are placed upon it. The plate so prepared is moved along the table to the juncture of the two rollers, and the upper roller being turned by the arms of the cross, the plate, with its furniture, is passed through the press. The rollers may be placed nearer to or farther from each other, according to the amount of pressure requisite for making a good impression, that is, according to the depth of the engraving and the degree of blackness which the impression is required to have.

PRINTING-MACHINE. The printing-press, though much improved during the last half-century by the ingenuity of Lord Stanhope and others [PRINTING-PRESS], is quite in-

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adequate to a rate of production equal to the present demand. The attention of practical men was consequently directed to some more rapid means of production, and as early as 1790, even before the Stanhope-press was generally known, Mr. W. Nicholson had letters-patent for a machine similar in many respects to those which have now come into use. Subsequently Mr. König, a German, conceived nearly the same idea, and meeting with the encouragement in this country which he failed to obtain on the Continent, constructed a printing-machine, and on the 28th of November, 1814, the readers of the 'Times' were informed that they were then for the first time reading a newspaper printed by machinery driven by steam-power. This printing-machine, though highly ingenious, was very complicated, and the machine of König was soon superseded by that of Messrs. Applegath and Cowper, the novel features of which were accuracy in the register, the method of inking the types, and great simplicity in hitherto very complicated parts. Printing-machines may be distinguished into single and double; the single being that in which only one side of the sheet of paper is printed, the double that in which both sides are printed before the sheet leaves the machine. The former is used for newspapers and that kind of printing in which it is not necessary for the two sides of the sheet to 'register,' that is, for the printing on one side to be exactly at the back of the other; the latter for books, in which it is essential that the printing on one page should correspond with the printing on the other when the sheets are folded. This important object of the register is effected by causing the parts to move at precisely the same speed. This being the principle of the register, its success will depend on great accuracy of workmanship in the mechanical parts. The accompanying representation of the printing-machine will furnish a correct notion of the several parts, and of the way in which motion is communicated to them. A sheet of paper is taken from the pile to be printed (as represented at the left-hand side of the drawing), and put into the machine by one attendant, and taken out printed on both sides by the other attendant, whose hand is shown under the cylinders. The accompanying sketch will show the principle of the printing-machine.

The sheet of paper taken from the table A is laid on the feeder B, which consists of girths of linen, tightly stretched by being passed round two cylinders. By the motion of this feeder the sheet is placed between the two systems of tapes which lie on the cylinder G: these tapes, of which one set is represented by the dotted line, and the other by the thin line, lie two and two over each other on the cylinders and small rollers *a*, *b*, *c*, *d*, *e*, *f*, *g*, *h*, *i*. The sheet of paper grasped between them is kept clean at the places in which it is in contact with them, and by the motion of the various parts is conducted under the first printing-cylinder H, and receives an impression from the types at C; thence by means of the cylinders I, K, to the second printing-cylinder L, where it receives an impression on the other side from the types at D. Thus printed on both sides, it is taken out at *e* by the attendant. The cylinders I and K are simply for the purpose of conveying the sheet steadily and smoothly from one printing-cylinder to the other. The sheet will be seen to be reversed in its progress from one set of types to the other, descending the left side of the first and the right side of the second printing-cylinder.

An inking-apparatus is placed at each end of the table M, N, which carries the types C, D, and which traverses backwards and forwards under the printing-cylinders L, H, and inking-rollers. The ink, received from a reservoir *k* by the two rollers *l* and *m*, is transferred from them to the surface of the table; the surface of the table inks the rollers *n*, *o*, and these, in their turn, ink the types as they pass backwards and forwards for each impression. The excellence of the printing depends in a great measure on the types being properly inked. In a machine arranged according to the accompanying diagram, the types are touched four times by the inking-rollers for each impression, and by increasing the number of rollers, any perfection of inking may be obtained. The machines commonly used for printing books will print from seven hundred to one thousand per hour, in perfect register; and for newspapers, printed on one side only, from four thousand to six thousand per hour.

PRINTING, CALICO. [CALICO PRINTING.]

PRIODON. [ARMADILLO, vol. ii., p. 354.]

PRION. [PETRELS, vol. xviii., p. 47.]

PRIONITES, Illiger's name for a genus of birds.

Generic Character.—Both *mandibles* slightly curved and compressed; the margins with strong denticulations. *Tongue* long, slender; the sides ciliated. *Wings* short, rounded. *Tail* lengthened, cuneated. *Feet* gressorial, as in *Merops*. (Sw.)

Mr. Swainson (*Classification of Birds*) remarks that every writer since the days of Linnæus (who at first actually classed them in the same genus) has placed the Motmots (*Prionites*) and the Toucans (*Ramphastos*) close together, not only from the similarity of their habits, but from the structure of the tongue, which in both is long, and so much ciliated at its sides as to resemble a feather; so far, therefore, he observes, the resemblance is unquestionable. 'But,' continues Mr. Swainson, 'the feet of the motmot are totally different from the toucan; they are not scansorial, but of that particular structure so common among the *Fissirostres*. The toucans, we know, from personal observation, to be gregarious, living in flocks, and seeking their food from the tops of lofty trees; the motmot is solitary, hiding in the deep shades of the forests, and, like other air-feeding birds, is always found sitting nearly motionless. Here, then, is a very obvious departure from the structure and habits of the toucan. The question then is, to what does it lead? If to the hornbills (which has been inferred from the structure of the feet), we should have no diminution in the size of the bill, which in both the hornbills and toucans is equally large, but in the motmot of an ordinary and proportionate size: we should further expect a bird which was gregarious, since both these groups are so. Yet there is nothing in the motmot, beyond its feet, which will at all assimilate it to the perchers; while its fissirostral habit of catching its food upon the wing, and the discovery of the broad-billed species, *Prionites platyrhynchus*, seems to us a conclusive argument for placing this genus in the fissirostral order, as more intimately connected to the Jacamars (*Galbula*) [KINGFISHERS, vol. xiii., p. 233], than to any other known genus.

Prionites Mexicanus.

Example, *Prionites Mexicanus*.

Description.—Green above, paler beneath; head and neck above crimson; ears black, varied, and tipped with bright blue stripes; belly white. (Sw.)

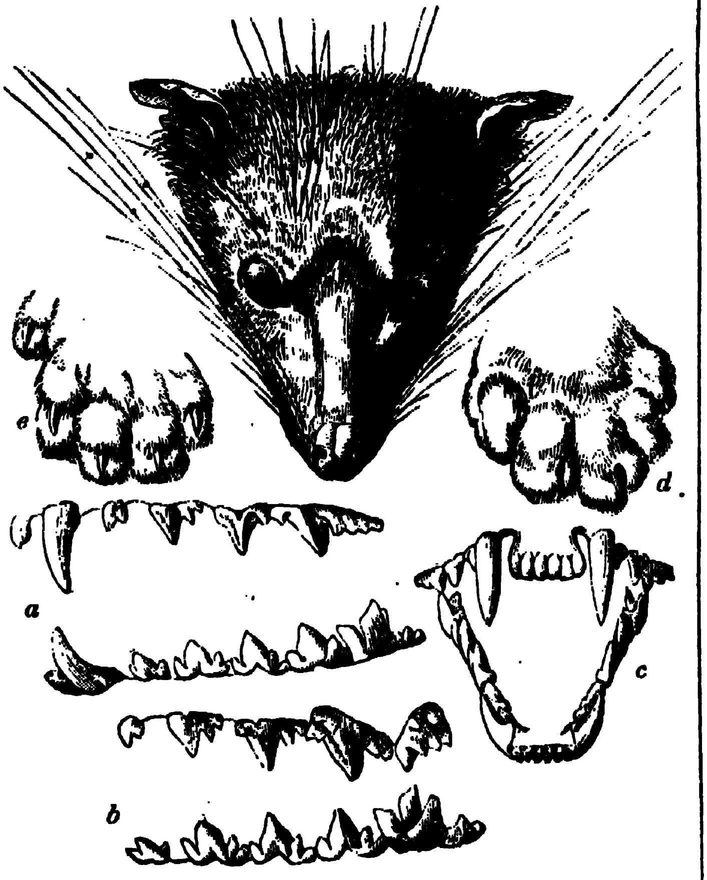
Food, Habits, Geographical Distribution.—Mr. Swainson (*Zool. Ill.*) states that the motmots or momots, 'so named from their monotonous note, live only in the tropical forests of the New World, preferring those deep recesses of perpetual shade [illegible] high canopy of matted foliage nearly excludes the rays of a vertical sun. They appear even more solitary in their disposition than the *Trogons*; their note may be heard, morning and evening, from the depths of the forests, but the bird is never seen, unless the hunter comes unexpectedly upon its retreat. This we have generally found to be a low withered branch completely shaded and just at the edge of such paths as are made by the Cavies or the Indians. The *Jacamars* and the *Trogons* both love these shady nooks, where they sit nearly motionless, watching for passing insects, on which they dart. Such is, no doubt, the manner in which the motmot feeds; but his strong conformation enables him to capture larger game. Travellers assert that he also devours the eggs and young of other birds, like the Toucans; this we believe, as both have the same long and feather-like tongue.'

Mr. G. R. Gray makes the *Momotinæ*, a subfamily of the *Todidæ*, consist of the genus *Crypticus*, Sw. (*Momotus*, Leadb.; *Prionites*, Sw.), and the genus *Momotus*, Briss. (*Baryphonus*, Vieill.; *Prionites*, Ill.; *Momota*, Shaw; *Ramphastos*, Linn.).

PRIO'NODON, Dr. Horsfield's name for a feline form (*Felis gracilis*, *Delundung* of the Javanese), and placed by him in a separate section under the name of *Prionodontidæ*, between *Felis* and *Viverra*. (*Zoological Researches in Java.*)

Mr. Swainson remarks (*Classification of Quadrupeds*) that of the genus *Prionodon*, at present, but one species has been found, in Java. As a familiar appellation, expressive, in all probability, of its analogy to the *Sorecidæ*, he terms it the *Shrew Cat*.

Dental Formula:—Incisors $\frac{6}{6}$; canines $\frac{1-1}{1-1}$; molars $\frac{5-5}{6-6}$



Head, teeth, and feet of Prionodon.
Head two-thirds of nat. size.

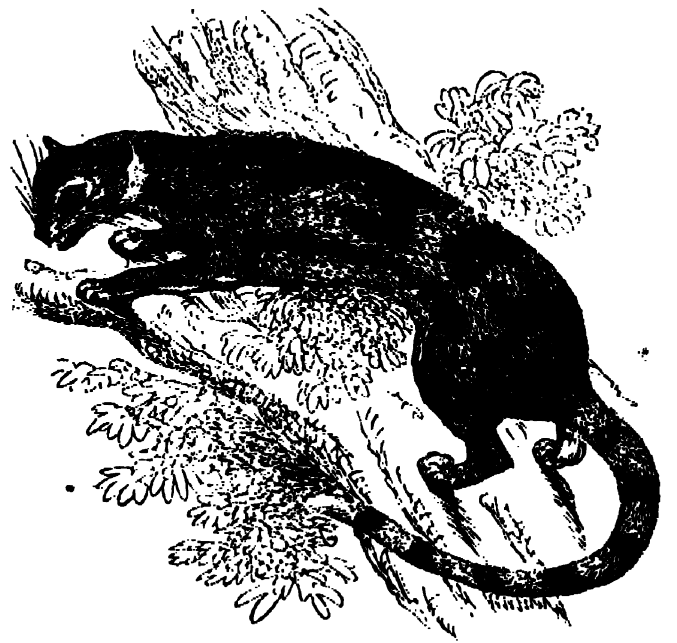
a, Lateral view (external) of the teeth; *b*, lateral view (internal); *c*, front view: *d*, fore-foot, covered with fur; *e*, hind-foot, fur removed: these last figures about one-fourth larger than natural size. (Horsfield.)

Mr. Swainson thus enumerates the distinguishing peculiarities of this interesting form as given by Dr. Horsfield:—

'In the number of toes on the hind feet, and of the teeth, as well as in the form of the head and body, this animal resembles the Gennets (*Viverra*); but the character of the claws and peculiar structure of the teeth indicate a decided affinity to the *Felinæ*. Both these families indeed have the incisive or cutting teeth alike, and those of the shrew cat are similar: nor does there appear any essential difference in respect to the canine teeth of the three. The cats have three or four cheek-teeth above, and three below; the *Viverræ*, on the contrary, have six; while our present animal differs from both, in having five above and six below. The pupil of the eye is circular; that of the genus [illegible] in some instances is the same, but in others oblong; while in the *Civets* it is transversely elongate. In the ears and form of the body, our animal much more resembles the *Viverræ* than the *Felinæ*; but in regard to colour it preserves a much closer relation to the genuine cats. The ears are short and round, the body long, and the legs short. From these facts it appears more natural to associate this singular animal with the present group (*Felinæ*) than with the Gennet family; inasmuch as although it wears the aspect and possesses some of the characters of the latter, it has others, more important to its economy and habits, which belong only to the *Felinæ*. So far we coincide with the views of those who associate *Prionodon* with the true *Felinæ*. But before this question can be ultimately decided, it is absolutely necessary that the circle of the *Mustelidæ* should be analysed. *Prionodon* may possibly be the type of *Felis*, in the circle of *Viverra*; or it may be, as we esteem it at present, an aberrant form of the group before us (Felinæ).'

Description.—Tail elongated, annulated, cylindrical; body pale flavescent, with four very wide dorsal bands and two narrow anal bands; two broad lateral striæ, the narrow cervical striæ, the numerous humeral and femoral spots, and the seven caudal rings very deep brown. (Horsf.)

Habits, Locality, &c.—Dr. Horsfield discovered this animal in 1806, during the early period of his researches in the district of Blambangan, situated at the extremity of Java; the natives distinguish it by the name above given. Dr. Horsfield was not able to ascertain that it is found in any other part of the island, or that it has another name; but he states that even in Blambangan it is rarely met with. He notices it as inhabiting the extensive forests which, with the exception of the capital of Banyuwangi and a few small villages, cover that district. He obtained but little information as to its habits and manners, and records nothing on the subject beyond what we have mentioned.



Prionodon gracilis. (Horsf., Java.)

PRI'ONOPS. [SHRIKES.]

PRIOR, PRIORY, ecclesiastical terms denoting certain monastic foundations and the heads of such foundations. They differ in nothing essentially from the terms abbot and abbey. There were in England religious houses, the chiefs of which were called priors, quite as rich and as powerful as many that had a chief who was called the abbot. Thus in Yorkshire there were two houses at no great distance from each other, called Roche and Nostel, the head of the former being an abbot, and of the latter a prior, though Nostel was the more antient and more considerable foundation. Neither has the distinction respect to the order to which the house belonged; for Kirkstall had an abbot, while Fountains had only a prior, and yet both were Cistercian houses. The prior of Saint John of Jerusalem was equal to any abbot; yet in the main we find the greater monastic foundations presided over by monks who were called abbots, as Glastonbury, Malmesbury, Tewkesbury, and others of ante-Norman foundation. In some cases there was both an abbot and a prior, when the abbot was regarded as the superior officer; and in the priories there was often a second officer called the sub-prior.

PRIOR, MATTHEW, was born on the 21st of July, 1664; it is uncertain whether at Wimborne in Dorsetshire, or in London, in which city his father is said to have been a joiner. His uncle, Samuel Prior, kept the Rummer Tavern near Charing-Cross. Matthew, on the death of his father, was taken charge of by his uncle, who sent him to Westminster school, then under Dr. Busby. When he was well advanced in the school, his uncle took him home with the intention of employing him in his business; but he had the good fortune to attract the notice of the earl of Dorset, who formed so favourable an opinion of his talents, that he sent him, in 1682, to St. John's College, Cambridge, where he was admitted to his bachelor's degree in 1686, and obtained a fellowship. Dryden's 'Hind and Panther' was published in 1786, and Prior, in conjunction with the Hon. Charles Montague, afterwards earl of Halifax, wrote, in ridicule of Dryden's poem, 'The City Mouse and Country Mouse,' which was published in 1687. After the Revolution of 1688, Prior came to London; and was introduced at court by the earl of Dorset, by whose influence he was appointed secretary to the embassy which was sent to the congress at the Hague in 1690, and his conduct gave so much satisfaction to King William, that he made him one of the gentlemen of his bedchamber. On the death of Queen Mary in 1695, Prior wrote an ode, which was presented to the king on his arrival in Holland after her death. In 1697 he was appointed secretary to the embassy which concluded the peace of Ryswick, and the next year filled the same office at the court of France, where he was treated with marked distinction. In 1799 he was at Loo in Holland with King William, by whom he was charged with dispatches to England, and on his arrival was made under secretary of state, but losing his place soon after, on the removal of the earl of Jersey from the office of secretary of state, he was made, in 1700, one of the commissioners of trade. This year he published a long and elaborate poem, the 'Carmen Seculare,' in which he celebrates the virtues and heroic actions of King William.

In the parliament that met in 1701, Prior sat as member for East Grinstead. Soon after this he joined the Tory party. In 1706 he celebrated the battle of Ramillies, in a long ode, which he inscribed to Queen Anne. In July, 1711, the Tories being now in power, Prior was sent privately to Paris with proposals of peace. In about a month he returned, bringing with him the Abbé Gualtier, and M. Mesnager, one of the French ministers, who was invested with full powers. The queen's ministers met Mesnager privately at Prior's house on the 20th September, 1711. This private meeting was made the ground of the charge of treason which the Whigs afterwards brought against Prior. The conferences began at Utrecht, on the 1st of January, 1712, but the business advanced so slowly that Bolingbroke was sent as ambassador to Louis XIV. at Paris, to forward it, and Prior either accompanied or followed him. After Bolingbroke's return, Prior acted as ambassador, though he was not officially appointed till August, 1713: his public dignity however was of short duration, for on the 1st of August, 1714, the Tories lost office, and Prior was recalled by the Whigs, by whom he was committed on a charge of high treason, and remained in custody two years. During his confinement he wrote his poem of 'Alma.' He was now without the means of subsistence, except from his fellowship, which he still retained; but the publication of his poems by subscription, which amounted to 4000 guineas, and an equal sum added by Lord Harley, son of the earl of Oxford, for the purchase of Down-hall in Essex, which was settled upon Prior for his life, restored him to easy circumstances. He died at Wimpole, a seat of the earl of Oxford, in Cambridgeshire, September 18, 1721, at the age of 57. A monument was erected to him in Westminster Abbey; and for this and the Latin inscription upon it, which he directed in his will to be written by Dr. Robert Friend, he left 500*l*.

Prior seems to have been well fitted for the public situations which he filled. It is evident that he was skilled in the art of pleasing, an important requisite in a diplomatist. He secured the approbation of the English sovereigns and ministers who employed him, and his influence at the French court was undoubted. Wh[illegible] joined the Tories he became, as is usual in such [illegible] violent partisan; and the charge of high treason and [illegible] years' imprisonment were the result of a malignant persecution to which he had exposed himself by his desertion of the Whigs.

In his private habits he appears to have been negligent and sensual. It is stated, on the authority of Spence, that the woman with whom he lived was 'a despicable drab of the lowest species.' It is evident however that he secured the esteem and affection of a large circle of associates; he became indeed almost a member of the family of the earl of Oxford.

Prior, as a poet, was once popular, but is little read now. His lighter pieces are the most attractive. His Tales, though borrowed and mostly indecent, are told with ease and sprightliness, and his Epigrams are often neatly pointed. His 'Alma, or the Progress of the Soul,' the style of which is professedly an imitation of that of 'Hudibras,' has not much either of philosophy or wit in it, but is written in a very lively manner. 'Solomon' is one of the best of his poems. It is a sort of epic, formed out of the 'Proverbs' and 'Ecclesiastes.' The reflections are elaborately expressed, and often with great felicity of diction, but being without character or incident, it is rather heavy reading. 'Henry and Emma' is displeasing from the improbability both of the circumstances and sentiments; yet it was once a favourite with the public. Johnson very truly calls it a 'dull and tedious dialogue.' His smaller occasional poems are deformed by the continual introduction of the deities of the Grecian and Roman mythology. Venus and Cupid and Mars and Mercury and Jupiter meet us at every turn. Prior is fortunately one of the last of that race of poets who sought for ornament in these school-boy allusions. On the whole, it may be said of Prior that he had none of the higher qualities of a poet—no invention, little power of imagination, and consequently no vividness of description. He has diligence and judgment, and he may be regarded as one of the most correct of English poets. A 'History of the Transactions of his own Times,' for which he had been collecting materials, was published after his death, in 2 vols. 8vo., but it has little in it of Prior's, and is of small value.

(Johnson's *Lives of the Poets*; *Life of Prior*, by Humphreys; *Biographie Universelle*; Campbell's *Specimens of the British Poets*.)

PRIORITY. [Notice.]

PRISCIA'NUS was a celebrated Roman grammarian, who is said to have been born at Cæsarea; but we have hardly any particulars respecting his life. It appears that he was appointed professor of grammar at Constantinople in the reign of Justinian, about A.D. 525 (Fabricii *Bibliotheca Latina*, vol. iii., p. 398, ed. Ernesti); and we may infer from this circumstance, as well as from several passages in his works, that he was a Christian. He received instruction himself from Theoctistus, whom he frequently mentions with great praise.

Priscian's work 'De Arte Grammaticâ' is comprised in eighteen books, and is dedicated to Julian, whom some modern writers have erroneously supposed to be the emperor of that name. This work, which is the most complete treatise on the Latin language that has come down to us from antiquity, supplied the materials for most of the Latin grammars published at the revival of learning; and the estimation in which it was held at that time is shown by the fact that five editions of it were published between the years 1470 and 1495. Modern scholars may still consult it with profit; it is particularly valuable for the number of quotations which it contains from writers whose works have not come down to us. Besides this work, the following treatises of Priscian's are extant:—'De XII. Versibus Æneidos principalibus ad Pueros,' 'De Accentibus,' 'De Declinatione Nominum,' 'De Versibus Comicis,' 'De Præexercitamentis Rhetoricæ,' 'De Figuris et Nominibus Numerorum et de Numis ac Ponderibus.' The best editions of Priscian are by Putschius, in his 'Grammaticæ Latinæ Auctores antiqui,' 4to., Hanov., 1605, and by Krehl, 8vo., Lips., 1819-20. The 'Opera Minora' were also edited by Lindemann, 8vo., Lugd. Bat., 1818. His treatise on Comic Metres is included in Gaisford's 'Scriptores Latini Rei Metricæ,' 8vo., Oxon., 1834.

Priscian also wrote a short poem entitled 'De Laude Imperatoris Anastasii,' which was published for the first time by Endlicher, 8vo., Vindob., 1828.

PRISCILLIA'NUS. [Office, Holy.]

PRISM (πρίσμα), in Mathematics, is a solid formed by a straight line which moves parallel to a given straight line, and one end of which traces out the contour of a given rectilinear polygon. The other extremity of the moving straight line traces out an equal and similar polygon, placed parallel to the former one: and the prism is thus bounded by two equal and parallel polygons, joined by as many parallelograms as each polygon has sides. When these parallelograms are at right angles to the planes of the polygons, the solid is called a right prism; in all other cases, an oblique prism. The prism is among plane solids what the cylinder is among curvilinear ones: it is also called triangular, quadrangular, pentagonal, &c. according as the polygons have three, four, five, &c. sides. Thus the prism used in optics is a triangular prism, while the parallelopiped is a quadrangular prism.

The number of cubic units in the content of a prism is found by multiplying the number of square units in either of the polygons by the number of linear units in the perpendicular distance between the planes of the two polygons; and all prisms, however much they may differ in obliquity, which have equal bases, and equal heights or perpendicular distances between opposite polygons, are equal in magnitude.

No other rule can be given for computing the surface of a prism except the simple direction to add the areas of the two polygons to those of the joining parallelograms. But in the case of a right prism, the finding of the parallelograms may be shortened by multiplying the number of linear units in the contour of one polygon by the altitude of the prism.

PRISM. (Optics.) [Refraction.]

PRI'SODON, Schumacher's name for a form among the *Naiades*, *Hyria*, &c. of authors. [Naiades.]

PRISON. [Transportation.]

PRISTIDACTYLS, the name assigned by MM. Duméril and Bibron to a group of *Cœlodonts*, being the second of their *Lézards Lacertiens ou Autosaures*. The Lacertians of this group are those which have the toes either dentilated laterally or carinated on their inferior surface, or provided both with carinations below and dentilations along their edges. None of them have the temples covered with plates or large scales. In the greater part of the species the plates which surround the nostrils are more or less convex, the palpebral disk is nearly completely surrounded with a *cordon* of granules, and the ventral lamellæ, as well as the preanal scales, are smaller and more numerous than in the *Leiodactylous Cœlodonts*.

The following genera are arranged by MM. Duméril and Bibron under this group:—

Psammodromus, Fitz. (*Notophilis*, *Aspistis*, Wagl., Bonap., Wiegm.; *Psammodromus*, Wiegm.).

Ophiops, Ménestriés (*Amystes*, Wiegm.). [Ophiops.]

Calosaura, Dum. and Bibr.

Acanthodactylus, Fitz. (*Podarcis*, part, Wagl.).

Scapteira, Fitz. [Scapteira.]

Eremias, Fitz. (*Podarcis*, part, Wagl.).

PRITTLEWELL. [Essex.]

PRIVAS, a town in France, capital of the department of Ardèche, situated on the little river Ouvèze, 382 miles from Paris by Lyon and Valence, in 44° 44′ N. lat. and 4° 35′ E. long.

This small provincial capital is on a hill rising out of a pleasant valley. It has few public structures of any importance. There are an old castle, and a convent of Recollet monks, now converted partly into a court of justice and partly into barracks. The population of the commune in 1831 was 4342. The townsmen are engaged in throwing and manufacturing silk, and carry on trade in leather. There are coal-mines in the neighbourhood. Privas has a subordinate court of justice, several fiscal government offices, a house of correction, a library, and an agricultural society. The town was taken from the Huguenots, A.D. 1629, by Louis XIII.

The arrondissement of Privas had, in 1831, a population of 107,696. It comprehends 107 communes, and is divided into ten cantons or districts, each under a justice of the peace.

PRIVATEER, a private ship of war, fitted out at the cost of an individual for the purpose of carrying on hostilities on his own account, but under the sanction of a belligerent state, against the public enemy. It is the practice of most nations to commission vessels of this kind as auxiliaries to the public force. The owners of them are licensed to attack and plunder the enemy, and their enterprise is encouraged by allowing them a large portion of any property they may capture. By the law of nations they are not considered pirates. It is usual for the country on whose behalf they carry on war to take security for their duly respecting the rights of neutrals and allies, and observing generally the law of nations. [Prize.] (45 Geo. III., c. 72; 1 Kent's *Commentaries*, 96.)

PRIVILEGE (*Privilegium*, from the sense of which however it has been perverted), a particular beneficial exemption from the general rules of law. Privilege is of two kinds; *real*, attaching to place, and *personal*, attaching to persons, as ambassadors, peers, members of parliament, attorneys, &c., whose peculiar privileges are stated under these heads respectively.

Formerly many places conferred the privilege of freedom from arrest, even in criminal matters, upon those entering them [Sanctuary]; and even in later times many places existed which privileged those within them from arrest in civil suits. Of these the most notorious were White Fryars, the Savoy, the Mint, and other places in their neighbourhood. But by 8 & 9 Will. III., c. 27, the privileges of all these places were abolished. However, at the present time, no arrest can be made in the king's presence, nor within the verge of the palace of Westminster, nor in any palace where he resides, nor in any place where the king's justices are sitting. (3 *Inst.*, 141.) Personal privilege, conferring freedom from arrest, is enjoyed by all suitors, counsel, witnesses, or other persons attending any courts of record upon business, or an arbitrator under a rule of Nisi prius. This exemption is to be interpreted liberally, and will not therefore be forfeited by taking refreshment after a suit, or by going other than the direct road to or from a court. (Com., *Dig.*, tit. 'Privileges.')

PRIVILE'GIUM. [Law.]

PRIVY COUNCIL (Consilium regis privatum, concilium secretum et continuum concilium regis). The privy council, or council table, consists of the assembly of the king's privy councillors for matters of state. During the existence of the Star-chamber, the members of the privy council were also members of that court. Their number was anciently about twelve, but is now indefinitely increased. The present usage is, that no members attend the deliberations of the council who are not especially summoned for that purpose. They must be natural-born subjects of England, and are nominated by the king without any patent or grant. After nomination and taking the oath of office, they immediately become privy councillors. Formerly they remained in office only during the life of the king, who chose them subject to removal at his discretion; but by 6 Anne, c. the privy council continues in existence six months after the demise of the crown, unless sooner determined by the successor, and they are to cause the successor to be proclaimed. The privy council of Scotland is now merged in that of England, by 6 Anne, c. 6. The duties of a privy councillor, as stated in the oath of office, are, to the best of his discretion truly and impartially to advise the king; to keep secret his counsel, to avoid corruption, to strengthen the king's council in all that by them is thought good for the king and his land, to withstand those who attempt the contrary, and to do all that a good councillor ought to do unto his sovereign lord. By the Act of Settlement (12 & 13 Will. III., c. 2) all matters relating to the government properly cognizable in the privy council are to be transacted there; and all the resolutions taken thereon are to be signed by such of the privy council as advise and consent to them.

The court of privy council is of great antiquity; and during earlier periods of our history appears not always to have confined itself to the entertainment of mere matters of state. It had always and still has power to inquire into all offences against the government, and to commit the offenders for the purpose of their trial in some of the courts of law; but it often assumed the cognizance of questions merely affecting the property and liberties of individuals. This is evident from the complaints and remonstrances that so frequently occur in our history, and ultimately from the declaratory law of the 16 Ch. I. referring to such practices. Probably the very statement of Sir Edward Coke, that the subjects of their deliberation are the 'publique good, and the honour, defence, safety, and profit of the realm....private causes, lest they should hinder the publique, they leave to the justices of the king's courts of justice, and meddle not with them,' proceeded from his knowledge that such limits had not always been observed, and his jealousy of their invasion. Several other passages in his works seem to show that this was so. These encroachments, in one arbitrary reign, received the sanction of the legislature. By 31 Hen. VIII., c. 8, the king, with the advice of his privy council, was empowered to set forth proclamations under such pains and penalties as seemed to them necessary, which were to be observed as though they were made by Act of Parliament. It is true there was an attempt to limit the effects of this, by a proviso that it was not to be prejudicial to any person's inheritance, offices, liberty, goods, or life. The statute itself however was repealed in the first year of the ensuing reign. The king, with the advice of his council, may still publish proclamations, which are said to be binding on the subject; but the proclamations must be consonant to and in execution of the laws of the land. The attempts to enlarge the jurisdiction of the council appear always to have been resisted as illegal; and they were finally checked by the 16 Chas. I., c. 10. That statute recites that of late years 'the council-table hath assumed unto itself a power to intermeddle in civil causes, and matters only of private interest between party and party, and have adventured to determine of the estates and liberties of the subject, contrary to the laws of the land, and the rights and privileges of the subject.' By the same statute it is declared and enacted that neither his majesty nor his privy council have or ought to have any jurisdiction in such matters, but that they ought to be tried and determined in the ordinary courts of justice, and by the ordinary courts of law.

Subsequently however to this statute, in matters arising out of the jurisdiction of the courts of the kingdom, as in colonial and admiralty causes, and also in other matters, where the appeal was to the king himself in council, the privy council continued to have cognizance, even though the questions related merely to the property of individuals. By 2 and 3 Wm. IV., c. 92, the powers of the high courts of delegates, both in ecclesiastical and maritime causes, were transferred to the king in council. The decision of these matters being purely legal, it was found expedient to make some alterations in the court, for the purpose of better adapting it to the discharge of this branch of its duties. Instances had before occurred where the judges had been called in and had given extra-judicial opinions to the privy council; but the practice was inconvenient and unsatisfactory, and all necessity for it is now wholly removed. By the 3 and 4 Wm. IV., c. 41, the jurisdiction of the privy council is further enlarged, and there is added to it a body entitled 'the judicial committee of the privy council.' This body consists of the keeper of the great seal, the chief justice of the King's Bench and of the Common Pleas, the master of the rolls, the vice chancellor, the chief baron of the Exchequer, the judges of the prerogative court of Canterbury and of the high court of admiralty, the chief judge of the bankruptcy court, and all members of the privy council who have been presidents of it or have held the office of chancellor or any of the before-named offices. Power is also given to the king by his sign manual to appoint any two other persons who are privy councillors to be members of the committee. In the third section of the act are enumerated the appeals which are to be referred to this committee. They are authorised to examine witnesses on oath, and to direct an issue to be tried by a jury. The same powers for enforcing their decrees, &c. are given to the judicial committee as are possessed by the Court of Chancery, King's Bench, &c. A registrar is also attached to the committee, to whom matters may be referred, as in chancery to a master.

The privileges of a privy councillor, beyond those of mere honorary precedence, formerly related to the security of his person. If any one struck another a blow in the house or presence of a privy councillor, he was fineable. Conspiracy by the king's menial servants against the life of a privy councillor was felony, though nothing were done upon it. And by 9 Anne, c. 16, any unlawful assault by any person on a privy councillor in the execution of his office was felony.

These statutes have however been now repealed, by 9 Geo. IV., c. 31, and any offence against a privy councillor stands on the same footing as offences against any other individual. (1 Co. Lit., 110, a, n. 5; 3 *Inst.*, 182; 4 *Inst.*, 52; 1 Bl., *Com.*, 222; Hallam's *Constitutional History*.)

PRIZE, property taken from an enemy. The term is generally applied to property taken at sea exclusively. The law of prize is regulated by the general law of nations. As between the belligerent powers themselves, the property in a ship or other thing captured passes at once, by the mere taking itself, to the captor. But the thing captured may be purchased from the captor by a person belonging to a neutral state, or it may be recaptured. It becomes therefore necessary, as between the original owner and such purchaser, or between the original owner and the recaptor, to lay down some rule for determining at what time and under what circumstances the thing captured becomes prize, so that the property in it passes to the captor for all purposes. The law of nations upon this point was very vague and unsettled. It used to be said that property was not devested by capture until after possession had been retained twenty-four hours, or until the prize had been taken infra præsidia; or again, until the spes recuperandi was gone. The present rule is thus expressed by Lord Stowell:—'By the general practice of the law of nations a sentence of condemnation is at present deemed generally necessary, and a neutral purchaser in Europe during war looks to the legal sentence of condemnation as one of the title-deeds of a ship, if he buys a prize vessel.' Sentence of condemnation, that is, sentence that the thing captured is prize, and that consequently the property of the original owner in it is entirely devested, must be pronounced by a court of the capturing power duly constituted according to the law of nations. The prize court of the captor may sit in the territory of an ally, but not in that of a neutral. Questions of prize are by the English law disposed of in the courts of Admiralty. [ADMIRALTY.]

(45 Geo. III., c. 72; 1 Kent's *Commentaries*, 100; Douglas's *Reports*, p. 612.)

PRIZE-MONEY. All the acts relating to army prize-money have been repealed by the 2 and 3 Wm. IV., c. 53, which also enacts that all captures made by the army shall be divided according to such general rule of distribution as the king shall direct.

PROBABILITY, PROBABILITIES, THEORY OF. A conclusion may be said to be known in two distinct ways: first, when it is derived from those principles (as we call them) which may be considered as common to all mankind, or which at least no one is found to deny; secondly, when it results, by a sure process of inference, from premises which are believed to be known. Whether these premises are properly known, that is to say, whether another person assuming to decide on the propriety or impropriety is satisfied or not, is not a part of the present inquiry. That knowledge of the first kind exists is unquestioned, and most of the results of such knowledge are agreed upon. That knowledge of the second kind exists is also unquestioned, though two men may differ as to whether a given conclusion is part of it or not. The distinction, as elsewhere noticed [MATHEMATICS], is positive, easily apprehended, and useful; it exists moreover, and must exist, whatever may be the system of metaphysics on which one man or another may explain it.

In the exact sciences, demonstration is always effected in such a way as to show that nothing contradictory of the proposition demonstrated either is true or can have been true at any time. Two sides of a triangle are, were, and always will be, greater than the third; by which we mean that persons with minds constituted as ours are, must have admitted this, must now admit it, and must admit it in all time to come. Those who should deny the proposition must really hold that a whole may be less than its contained part: such is the alternative which geometrical demonstration offers for acceptance, and we should cease to consider a mind as the proper object of instruction which should prefer the alternative to the proposition. Such truths as these are not the subject of the present article.

The other class of conclusions consists of those which may be false, or which may have been false at one time, or may become so, without the necessity of our supposing an absolute and inconceivable difference of mental constitution between ourselves and the person who may have seen this falsehood, may now see it, or is to see it. Many such conclusions appear to be as certain as if they were absolutely demonstrated; until a close and (to those who have not considered the subject) a captious test is applied, which shows that this certainty is not what is called mathematical certainty. One of the most certain perhaps of all is this: a ball of iron suspended by a thread will fall to the ground when the thread is cut; every one is as well persuaded of this truth as of the two sides of a triangle being together greater than the third; those who have not studied geometry know the former much better than the latter. But let any one assert that he has seen, in a part of Africa unexplored except by himself, a ball of iron suspended in the air, which, though iron to the touch and iron to every *chemical* experiment, not only remains in the air without support, but, when forced to the ground, rises again of itself to the same height. We should laugh and disbelieve it, but we could not disprove it; in spite of our laughter and unbelief, no man can know such a thing to be false. Let a number of credible persons solemnly declare that they have seen the same phenomenon, and our unbelief would be shaken: finally, let it be matter, as it is called, of common notoriety, and let a continual succession of good witnesses passing and repassing constantly confirm each other in the recital above mentioned, and our positive disbelief would be changed into as positive a belief. But let a new witness declare that the natives use bows and arrows of the common form, in which the straight string of the bow, meaning that part of it which joins the extremities of the bow, is four or five times as long as the curved bow itself; though our disbelief of this first witness would not be sensibly stronger than our disbelief of the first witness in the preceding case, yet it must be of this kind, that any succession of respectable witnesses, however numerous, could never add any force to the fact in a mind which can properly appreciate the grounds of the assertion that a straight line is the shortest distance between the two points. A million of witnesses could do no more than one to establish the fact stated, in the mind of a person who knows what geometrical demonstration is; though it is just possible that another, who only learns the connection of the sides of a triangle from experiment, may be capable of being convinced of the second assertion by evidence, as well as of the first.

The *probability* of an asserted fact or conclusion means, in common language, the degree of belief which we think we ought to accord to it, and it depends in each mind upon the amount of evidence offered, the degree in which that evidence is understood, the fitness of that mind to receive and be acted on by evidence, and in particular by the evidence which is offered. Evidence insufficient, or ill understood, or offered to a mind which is unduly credulous or sceptical, whether to the particular sort of evidence in question or to evidence in general, may give a low degree of probability, or none at all, to what another mind considers as indisputable; or the contrary. In the common use of the word, a result is said to be probable only when the mind inclines more or less to believe it, and improbable in the contrary case. The mathematical use of the term is rather different; but, till further notice, we retain the common signification.

We mean by evidence, in the present inquiry, not merely oral or written testimony, but everything which disposes the mind, however little, to adopt or reject, including even the effect of previous knowledge. The value of evidence, that is, the extent it should go towards inducing belief, is really the subject of inquiry in a branch of exact science known by the name of the *theory of probabilities*. But how can the value of evidence be made a subject of measurement? why can this be done in the case of an amount of credibility more than in that of an amount* of benevolence courage, or talent? We should assuredly think any one must be in a curious delusion who should suppose himself *to have ascertained, from the data given by Homer, that the warlike skill of Achilles was exactly 552 times that of Thersites, and that Shakspere had done the former a foul* wrong, for that he had made it only 237 times and a fraction. But what is the difference, in the nature of the inquiry sought to be instituted, between attempts to measure prowess and probability? On the mode of answering this question depends whether we are to make our subject merely, as tofore, a kind of artificial method of judging the chances of a game of hazard; or, a rational and exact mode of doing, when data are sufficient, that which we daily attempt to do, as well as we can, with our inaccurate appreciations of the circumstances of common life, and a science to be used, as are others of a mathematical nature, for accustoming ourselves to estimate or guess with something like accuracy, by habitual acquaintance with cases in which absolute accuracy is attainable.

When we consider all the circumstances which affect belief or opinion, both those which are external and those which depend on the mind which is exposed to them, it may well bewilder the imagination of a person not accustomed to the idea, when he hears of an attempt to reckon credibility in numbers, and to deduce what are called exact conclusions from hypotheses as to the force of assertions. To remove from the threshold of the subject the incredulity which must exist and ought to exist, in the first instance, let us suppose the other branches of science presented to a student not in their simple beginnings, but by a description of their ultimate physical objects. To put this beginner in a state parallel to that of readers in general with respect to the subject of probabilities, he must be of mature age, with very little knowledge of number, none of any other branch of mathematics, and no conception of the construction or use of any philosophical instrument, nor of the object and procedure of any one experiment. He might then be addressed as follows:—'You are, without moving from this earth, to track the motions of all the heavenly bodies, to be able to ascertain where they were or will be at any moment of time past or future, to measure their sizes, to weigh their contents, and to find the species and amount of insensible forces which, by some unknown means, they exercise on one another. You are to detect the existence of a subtle fluid which can neither be seen, heard, nor felt, to measure vibrations of which there are millions in a minute, and to trace the course of effects which travel hundreds of thousands of miles in a second. You are to weigh against each other atoms of matter of which it cannot be shown that millions put together would be visible to the eye' The person so addressed would not be less bewildered nor more disposed treat the proposed results as fictions, than he who hears for the first time of a numerical theory of probabilities. But let us now reverse the method, and suppose the learner allowed to begin at the beginning. He first finds that, step by step, his rude notions of number are organised into a method of computation which enables him easily to perform more than he could have imagined the most subtle brain to have devised. From notions of the simplest kind connected with space, properties of figure become almost intuitive, of which he could at one time not have comprehended the description, far less the demonstration. By reasoning on the simplest properties of matter, such as can be proved to his senses, he finds no difficulty in tracing remote and complicated combinations of effects from the plainest causes, by which he learns to invert this process, and to reduce observed combinations to their simplest elements. But if, during this long and very gradual process, he were to keep continually before his mind those great results the knowledge of which he had been promised, looking to arrive at the fulfilment of the promise by some sudden acquisition of power, his whole course would be one of disappointment. He would be peeping forward a few pages in his Euclid, in hopes of seeing himself almost arrived at the means of calculating an eclipse or explaining the theory of colours, and would find that he was to learn how to make a square equal *to a given figure instead.*

Now the application of the preceding description to our present subject is as follows:—The beginner in exact science has usually no definite notions as to the end which he is to arrive at; nor do the terms algebra, geometry, mechanics, &c. suggest any associations beyond a vague notion that they are parts of a learned system. But it is impossible that the beginner in the subject of this article should be without an explicit and probably an exaggerated notion of what he is to attain. There is no unknown Greek or Arabic term the meaning of which must be slowly learned by the study of the science of which it is the name; the word *probability*, so well known in the common affairs of life, stares him in the face at the head of every page, and reminds him to be dissatisfied with the extent of power gained, up to the point at which he has arrived. Unless then he can make up his mind to descend, as a student would do who, having in his head the theory of gravitation and the laws of light, should lay by these grand ideas, and set himself to trace the consequences of the simple notion that two straight lines cannot enclose a space—he must be warned that he will be likely to quit the subject in disgust. We now proceed to the fundamental points of the theory.

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* It is rather for the argument that we endeavour, however imperfectly, to numerical standards of use in estimating every one of these qualities, a we put down at hazard before the matter of this note suggested itself. re apt to compare the benevolence of two persons by the pecuniary re- of their liberality; confounding the two qualities, but perhaps the very usion arises partly from the numerical measure which is thereby supposed able. We form a vague notion of the comparative courage of two sol- by comparing the different amounts of danger which we think they have : a most unfair and fallacious test, but still indicative of the tendency to ure. Finally, we measure talent in a more rational, though still imper- manner, by trials of what competitors can do under the same circum- es and in the same time.

That opinion may be formed with more or less strength, particularly when the subject-matters are of different species, is well known to every one from his own experience. The most decided republican in England, for instance, is not so sure of the wisdom of the Long Parliament as he is that all its members are now dead; and no royalist, however well persuaded of his tenets, thinks the Restoration was of as much consequence to this country as sun, wind, and rain. It matters nothing that the different degrees of assurance refer to very different matters, and are obtained in very different ways; that they are separate amounts of the same kind of feeling is universally felt and admitted. To make something like a gauge for these degrees of belief is not difficult; to apply it is a harder task, seeing that the cases which present circumstances of sufficiently definite character are seldom met with.

Suppose a box to contain 3 white and 4 black balls; it is easily admitted that it is more likely that a black ball should be drawn than a white one, on the supposition that the drawer does not see the balls. Or rather we should say it is easily admitted that every well regulated mind *ought* to think a black ball more likely than a white one: and that if any one should imagine the contrary, he has formed an opinion from prejudice, fancy, or want of proper consideration. Just as we should say that if all the balls were black, a black ball would certainly be drawn, so when a majority of the balls is black, and each one ball is as likely to be drawn as any other, there are more ways of drawing black than white, and we look upon the former as more obtainable, and more likely to be obtained, than the latter. Common experience makes us consider the black as more likely than white, when the number of black balls is much greater than that of white balls; as, if there only 3 white balls, and a million of black ones. Here, as in other questions of magnitude, we can see a difference when the difference is great, which we must perhaps learn to see when it is small: it is plain enough that the black is more likely than the white when there are a million of black balls to one white; but not so easily grasped that the black is more likely than the white when there are five hundred thousand and one black balls to five hundred thousand white.

The next step to be made is the assertion that when there are 3 white and 4 black balls, the probability of drawing white is to that of drawing black in the proportion of 3 to 4; that is, if we could by a voluntary act make our impressions of the probability of future events of that strength which our reason tells us they ought to have, we should choose to expect a black ball more strongly than a white one in the proportion of 4 to 3. The principle on which we do this is the main point of the theory, the only objectionable part, if there be one: for all the rest is mathematical deduction.

The principle is as follows:—When any number of events, A, B, C, &c., are such that one and only one can happen at a time, and when *a*, *b*, *c*, &c. are the numbers of ways in which they can severally happen, the probabilities of the several events are in the proportions of the numbers *a*, *b*, *c*, &c. Returning to the preceding simple instance, we have an obvious negative reason for supposing that the probabilities should be as 4 to 3, since there is no imaginable ground for assuming, while the excess of black balls is the sole cause of the superior probability of drawing one of them, that this excess of probability should be in any other proportion than that of the excess of black balls. If we grant the following, namely, that the probability of having one or other out of two of the different results which a trial may give, is, or ought to be, the sum of the probabilities of the two separately, we shall be obliged to admit positive reason for the preceding principle, as follows:—Suppose a box to contain 10 balls, marked 1, 2, &c. up to 10, and no others. A ball is to be drawn, and the drawer has in his mind an amount of hope, fear, or simple admission of possibility, as the case may be as to the happening of each number. If the drawing of No. 1 be to gain him a prize, there is a certain amount of hope; if it be to procure him a loss, of fear; if neither one nor the other, of feeling that No. 1 may be that which is drawn. Now let either 1 or 2 bring the gain or loss; is the feeling of hope or fear doubled in strength? or rather, *ought* it to be doubled? He who admits this, admits the whole theory of probabilities, for all the rest is mathematical deduction. Let x be the proper numerical measure of the probability of drawing 1, or of drawing 2, &c.; these probabilities being equal, since there is, by the hypothesis, nothing to render one more likely than the other. Then, if the preceding be admitted, $2x$ is the probability that either 1 or 2 is drawn; $3x$, that either 1, 2, or 3 is drawn; and so on up to $10x$, which is the probability that one or other of the set 1, 2, 3, ... 10, shall be drawn. But since that a drawing shall take place is an absolute condition, one of the ten numbers must be drawn; hence x must be so taken that $10x$ shall be the numerical measure of certainty. It is indifferent what number is taken to stand for the exponent of certainty, as far as principles are concerned; but in a mathematical point of view, unity is more convenient than any thing else. Let unity be adopted, then $10x=1$, or $x=\frac{1}{10}$. Hence the chance of drawing, say one of the three, 1, 2, 3, is $\frac{3}{10}$; and that of drawing one of the remaining 7 is $\frac{7}{10}$. If then the first three should be white balls, and the last seven black, the chance of a white ball is $\frac{3}{10}$, that of a black one is $\frac{7}{10}$; and a black ball is more likely than a white one in the proportion of 7 to 3, which being an inequality in the proportion of 2⅓ to 1, the *odds* are said to be 2⅓ to 1 in favour of a black ball, or against a white one. By this we do not mean that every man *does*, in such a case, look for a black ball with an expectation 2⅓ times as great as his expectation of a white ball, but that, if he *could* measure the strength of his own feelings and adjust them with mathematical precision, he *would* proportion the strength of the two expectations in the preceding manner. And if money were to be spent upon the expectations, he may as reasonably give £2⅓ for a black ball, *before* it appears, as £1 for a white one.

It thus appears that the theory of probabilities is simply the reduction to numerical estimation, in cases which are perfectly known as to the number of events which may happen, of our comparative right to expect one or another event in preference to the rest. In the events of common life, we make estimations of this comparative right, but not *numerically*, because we are not in sufficient possession of the events which might have happened instead of the one which does happen. In such terms as barely possible, very unlikely, improbable, not improbable, as likely as not, rather likely, highly probable, almost certain, &c. we see a gradation which amounts to a rough attempt to make those comparisons which might be made numerically if the proper data could be obtained. The truth is, that almost every one naturally admits and practises the fundamental principles of this theory, though often, it may be, unskilfully. But it is not to be imagined that persons in general make an investigation like the preceding, nor indeed any investigation at all: how is it then that not only are these principles acquired, however imperfectly, by the majority of mankind, but the mathematical results which are obtained by those who professedly study the subject, are received almost universally; inasmuch that not only are they felt to be agreeable to common sense in a great majority of cases, but they are soon admitted to be sufficient indications that common sense is wrong, in the few cases in which they at first appear repugnant to it? The answer to this question leads to another view of the subject.

We all find, by every-day observation, that whenever an event of one kind happens permanently more often than one of another kind, there exists some reason for such frequency of occurrence, which, had it been inquired into before any event happened, would have enabled us to predict the frequency in question. So much is this the case, that if we were to take an observer to an urn in which were black and white balls, but how many of each he is not told, and were to make 1000 drawings, replacing the ball drawn after each drawing, and shaking the urn before every trial; if of the thousand drawings 822 were white and 178 black, he would be irresistibly led to conclude that there must be more white balls than black ones in the urn. Not that this is absolutely necessary; for it is barely possible that there may be only one white ball and 999 black ones, and that by a remarkable coincidence that one white ball may have come up 822 times out of the 1000 trials. More than this, a person used to observation would conclude, not only that there are more white balls in the urn, but that the proportion of white and black balls does not differ very greatly from that of 822 to 178. There is a disposition, derived from experience, to think that events happen in the long run in some sort of manner connected with the facilities afforded for their happening beforehand: and hence follows a disposition to judge what those facilities were from observed events, as well as to predict events from observation of those facilities; and it may happen that one person would draw his notion of likelihood from the first, and another from the second. Thus, if we were to put the question, 'What do you mean by saying that it is 5 to 3 for A against B?' one person might reply, 'I mean that in the long run A will happen 5 times for every 3 times which B happens;' while another might say, 'I mean that precedent circumstances are so arranged that for every 3 contingencies under which B may happen, there are 5 under which A may happen.' If these two persons were to dispute which was the *true* mode of viewing the subject, they would be fighting about nothing; for both are true, and each of them follows from the other: but if they were to differ as to which is the *common* mode, we should feel rather disposed to side with the one who was for the first answer.

The following problems, illustra[illegible] of the connection between the two modes, are the results of mathematical investigation. The table used is that given in **Mean**, which we have re-examined and find correctly printed: but two decimal places must be made in column A, and four in column B; thus 451 opposite to 4 must be read as ·0451 opposite to ·04, similarly ·8931 comes opposite to 1·14, and ·9825 opposite to 1·68.

Problem 1.—The probabilities of P and Q, at any one trial, are as a to b, that is, it is a to b for P against Q, and b to a for Q against P. A large number of trials $n(a+b)$ is made; what are the chances that the number of Ps which happen shall lie between $na+l$ and $na-l$, and (of course) the number of Qs between $nb-l$ and $nb+l$ (l being small compared with na or nb)?

Rule.—Calculate $(2l+1)\div\sqrt{\left(\frac{8\,nab}{a+b}\right)}$; let this be the A of the table (altered as above): then the corresponding B, altered as above, is the probability required.

Example.—It is 2 to 1 that a throw with a die shall give 3, 4, 5, or 6, and not 1 or 2: what is the chance that, in 12,000 throws, the number which give 3, 4, 5, or 6 shall lie between 8000+100 and 8000−100. Here $a=2$, $b=1$, $n=4000$, $l=100$, and the complete calculation by logarithms* (which we insert merely as a guide to the readiest mode of treating more complicated cases) is as follows:—

$n=4000$	3·6021	$2l+1=201$	2·3032
$a=\quad 2$	·3010		2·1646
$b=\quad 1$	·0000		———
8	·9031	1·376	·1386
	———		
	4·8062		
$a+b=3$	·4771		
	———		
	2)4·3291		
	———		
	2·1646		

In the table, A being 1·38, B is ·9490, which is more than near enough for the purpose, say ·95: the result then is that ·95 is the chance in favour of the throws which give 3, 4, 5, or 6 out of 12,000 throws lying between 8000+100 and 8000−100, whence ·05 is the chance against it; that is, it is about 95 to 5, or 19 to 1, that the throws shall so lie. A few instances of this kind will show how completely, in the long run, events may be expected to happen in numbers nearly proportional to what are called, when the precedent circumstances are fully known, their probabilities of happening.

Problem 2.—In the preceding problem, to find l so that there may be a given probability that the Ps shall lie between $na+l$ and $na-l$.

Rule.—Reduce the fraction which represents the given probability to a decimal fraction, and take the A corresponding to the B which is nearest to this fraction in the table: multiply by the square root above described, substract 1, and divide by 2; the whole number nearest to the result is the answer required for l.

Example.—In the preceding example, find l so that it is an even chance that the number of throws out of 12,000 which give 3, 4, 5, or 6 shall lie between $8000-l$ and $8000+l$. Here $\frac{1}{2}$ or ·5 is the given probability, the nearest to it in column B is ·5027 to which A is ·48, which multiplied by the square root (or the number whose logarithm is 2·1646) is 66·9: subtract 1 and divide by 2, which gives 33 very nearly: hence it is an even chance (very nearly) that the number of throws out of 12,000, which give 3, 4, 5, or 6 lie between 8000−33 and 8000+33.

Problem 3.—In $a+b$ trials, nothing whatever being known except what these trials tell, it is found that P happens a times, and Q happens b times: from which it is exceedingly likely that the probabilities of P and Q happening at a single trial would have been nearly as a to b, if we had known enough to form an *à priori* opinion. This we cannot do, by hypothesis: but, judging from the preceding events, with what degree of probability may we infer that if we had been able to form an *à priori* opinion, the odds for P against Q would have appeared to us to lie between $a-k$ to $b+k$ and $a+k$ to $b-k$?

Rule.—Calculate $k\div\sqrt{\left(\frac{2\,ab}{a+b}\right)}$; let this be A (in the table): then the corresponding B is the probability required.

Example.—In 600 drawings from an urn, the ball being replaced after each drawing, there were 418 white balls and 182 black ones. What is the probability that the proportion of white and black balls in the urn lies between that of 418−10 to 182+10 and 418+10 to 182−10, or that of 1000 to 471 and 1000 to 402? Here $a=418$, $b=182$, $k=10$; the square root above mentioned has 1·2021 for its logarithm, and 10 divided by this square root gives ·63 nearly. And A being ·63, B is also ·63 very nearly, which is the probability required; or it is 63 to 37, or nearly 2 to 1, that for every 1000 white balls in the urn, there are between 402 and 471 black ones.

Problem 4.—When P happens much oftener than Q, we feel a very high degree of probability (moral certainty) that the same thing would happen in the long run, or would continue how long soever we might go on trying, unless there should arrive some change of circumstances. But when P does not happen much oftener than Q, we do not feel the same degree of assurance; for though Q might really happen oftener than P in the long run, yet the casual fluctuations of events might make the contrary appear in any one set of trials. Suppose then that in $a+b$ trials, P has happened a times, and Q has happened b times, a and b being nearly equal: what presumption can thence be derived that the excess will be on the same side in the long run on which it is in the $a+b$ trials?

Rule.—Divide the difference of a and b by the square root of twice their sum: let the result be A, and find the corresponding B; to this add 1, and divide by 2: the result is the probability required.

Example.—Buffon, in a particular experiment, had to throw a coin (say a halfpenny) 4140 times; the result was 2048 heads and 2092 tails: what is the probability that some excess of tail over head would have continued for ever; that is, that the coin he used had in its construction some mechanical tendency to fall tail rather than head? Here $a=2048$, $b=2092$; the square root is ·48, which being A, B is ·50, and 1·50 divided by 2 is ·75, the probability required. This is $\frac{3}{4}$, so that it is 3 to 1 that some excess or other of tails would be found in the long run. Observe however that this does not mean an excess to the amount of 44 in every 4140 trials; but only *some* excess, small or great.

The experiment of Buffon, and its particular object, will be found in the 'Essay on Probabilities *and* Life Contingencies,' in the 'Cabinet Cyclopaedia;' in which work will also be found a larger collection of such problems as the preceding, with fuller explanation and more extensive tables. These problems have been here introduced that the reader may have an opportunity of comparing and verifying the general sameness of results which follows from the two (perhaps) apparently differing notions from which the idea of the measure of probability may be derived.

Previously to laying down a few general [illegible] we shall notice the error to which persons who have n[illegible]ought on the subject are most liable: this is a confusion between the sort of confidence which is to be given to a result of the theory of probabilities, and that which is claimed by actual demonstration. Many persons are not aware that out of mathematics the greater number of conclusions are *probable* results, many of them, it is true, so highly probable that their chance of falsehood does not amount to that of drawing a black ball from among a million of white ones; but still not absolutely demonstrated. These highly probable results (so probable that the word probable in its common sense is weak as applied to them) form the ordinary knowledge of common life, and being practical certainties, are considered and mentioned as certainties, the imperceptibly small chance that they may not be true being disregarded. Hence it happens that when a result of this theory is announced, with its proper chance annexed, and though the probability of its truth is so high that it may rank with the moral certainties of ordinary life, there is a morbid disposition to dwell rather upon the one way in which the proposition may fail, than upon the million of equally possible ways in which it may be true. Thus if it be said that it is ten millions to one that P will happen, and not Q, therefore it is morally certain that P will happen—it is objected, But how do we know that the very next event will not be precisely the one of ten millions which is Q and not P? The answer is, we do not *know* it in the absolute sense of the word; if we thus knew it, it would be a certainty that P would happen, and whether P would happen or not, would not be a question for the theory of probabilities at all: but we do know it in the common sense of the word, since there are hundreds of conclusions which all men call knowledge, which are not so probable that they can be reasonably shown to have ten millions to one in their favour.

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* In this, and many other cases, the four figure logarithms lately published by Taylor and Walton on a card, will be found by far the most convenient.

Another way in which the confusion we have mentioned shows itself is in the habit of reasoning against the probable truths just alluded to by arguments which could only be valid against an assertion that these truths were absolutely demonstrated. In compliance with the forms of language, those who advance such truths treat them as (moral) certainties: the opponent overthrows their (mathematical) certainty, and the fallacy lies in his supposing that he has thereby shown them not to possess that sort of truth which was claimed for them. For example, a medical man gives his opinion that a crime committed without any apparent motive is an indication of insanity: a newspaper ridicules this opinion, and asks, Are there no motives then which cannot be discovered? Now, if by apparent was meant apparent on the surface, or with slight examination, and if by indication was meant an absolute indication, certainly inexplicable except by the supposition of insanity, the answer is complete, and the opinion shown to be untenable. But suppose the energies of many acute persons and the resources of a whole nation to fail in making the motive of a crime apparent, and that this is what is meant by there being no apparent motive; suppose moreover that by an indication of insanity is meant a circumstance which renders insanity highly probable: the answer then is wholly irrelevant. The opinion, expanded into an argument, is—a crime committed absolutely without motive or object shows insanity; a motive, if it exist, may almost certainly be discovered by proper exertions; consequently the appearance of no motive, after all exertions to discover one have been tried, makes it most likely that the crime was an act of insanity: it is in fact as likely that the crime was an act of insanity, as it was unlikely that the exertions to discover a motive should have failed, if there had been a motive.

The application of this theory to the art of reasoning, in the numerical sense, is rendered practically impossible by our want of a proper numerical determination of the probability of premises. But the rules which we should follow, if such a numerical determination could be obtained, will show that a result of common sense is perfectly conformable to the theory, namely, that a considerable number of arguments, each of no overpowering force in itself, may, when put together and looked at conjointly, give a very high degree of probability to their common conclusion. Let there be already a conclusion, in favour of which the odds are a to b, and let an argument be introduced which, independently of all previous association, would give to the same conclusion the odds of A to B: then the effect of that argument upon the previous state of mind with resp[illegible] the conclusion ought to bring the odds for that concl[illegible] to those of $(A+B)(a+b)-Bb$ to Bb. Thus, let us suppose a person feels it to be 3 to 2 that a conclusion is true; he finds an argument from which alone he would conclude it to be 5 to 4 for the same: he ought then to regard the conclusion on the whole as having 9×5−2×4 to 2×4, or 37 to 8 in its favour. Let another argument be found for the same conclusion, such as would alone give it 4 to 1 in its favour; then the final odds should become 45×5−8×1 to 8×1, or 217 to 8 in its favour, and so on.

The preceding rule leads to this result, that any argument in favour of a conclusion, however weak it may be, adds something to the force of the preceding arguments: thus, if a conclusion have an even chance, or 1 to 1 for it, and if an argument be found for it which has only 1 to a thousand for its chance of being sound, the resulting odds for it are 2×1001−1×1000 to 1×1000, or 1002 to 1000; more than before. This result seems strange at first to many, whether it be announced in connection with this theory or not: but the strangeness arises from confounding a weak argument in favour of a conclusion with a strong argument against it. That weak arguments injure their cause arises from the supposition which they favour, that those who urge them have no strong ones, and from the opportunity which they give opponents to answer the weak ones, and pass over the strong ones. But if both sides were candid and well informed, the weaker arguments on each side would be allowed their due weight.

An argument may [illegible], and its conclusion not be necessarily false: let us now take the case of arguments on both sides, those which tend to establish the conclusion, and those which tend to establish something contradictory. Let P be the conclusion and Q a proposition, such that P and Q cannot be true together. Two cases arise, according to whether P and Q can both be false, or whether one of them must be true and the other false. Let the arguments for P, supposed to be joined by the preceding rule, give A to a for it; and let the arguments for Q, joined in the same way, give B to b for it. Then—

1. If, of P and Q, one must be true and the other false, it is $A\times b$ to $a\times B$ for P being true. Thus, if the direct arguments for P give 5 to 3 in its favour, and the direct arguments for Q, 2 to 1, it is 5×1 to 3×2, or 5 to 6 for P on the whole question.

2. If P and Q may both be false, it is $A\times b$ to $a(B+b)$ that P is true. Thus, in the last example, if both may be false, it is 5×1 to 3×(2+1), or 5 to 9 for P being true.

The various problems of which the solutions have been given are mathematical consequences of the definition of probability. Every such problem is simply one of combinations, however much the length of detail, and the number of mathematical abbreviations of the process of combining, may tend to make us lose sight of the first principle. At the same time it is found requisite to establish a few simple fundamental propositions, which we shall cite, with some consequences. As we are not writing an elementary treatise, we shall not demonstrate these propositions, referring the student to any of the modern works hereinafter cited. The probabilities of the events A, B, C, &c., are denoted by a, b, c, &c.

1. By the probability of A is meant the fraction which the number of cases favourable to the happening of A is of the whole number of cases, that is, both of those in which A can happen, and those in which it cannot. And the probability that A will not happen is $1-a$.

2. When A and B are events independent of each other, so that the happening of either in no way promotes or retards the happening of the other, the probability that both shall happen is ab; that neither shall happen, $1-a-b+ab$; that one only shall happen, $a+b-2ab$; that one or both shall happen, $a+b-ab$.

3. When A and B are mutually exclusive, that is, when if one happen the other cannot, the probability that one or other shall happen is $a+b$; and that neither shall happen, $1-a-b$.

4. If either A or B must happen, $a+b=1$; and if n trials are to be made, the several terms in the expansion of $(a+b)^n$ are the chances of the arrivals denoted by their exponents. Thus—

a^n is the chance that all are As.

$na^{n-1}b$, that $n-1$ are As and one is B.

$n\frac{n-1}{2}a^{n-2}b$, that $n-2$ are As and two are Bs, &c.

5. When an event has happened which may have sprung from any one of the sets of circumstances which we may describe by A, B, C, D, &c., and it is desired to find what is the probability of the event which did happen having arisen from one or another set, proceed as follows:—Had the circumstances denoted by A certainly existed, and the event been a contingency, let a be the probability that those circumstances would have produced the event; or briefly, let a be the probability that A, when certain, brings about the event. Let b be the same for B certain, c for C, &c. Then the probability that it was A which brought about the event which did happen, is the first of the following set:—

$$\frac{a}{a+b+c+\&c.},\qquad \frac{b}{a+b+c+\&c.},\qquad \frac{}{a+b+c+\&c.}$$

the probability that it was B is the second, that it was C, the third, and so on. Or, when convenient, instead of a, b, c, &c. may be substituted any whole numbers which are proportional to them. For example, let there be three lotteries, containing balls as follows:—

all white, 4 white, 1 black, 2 white, 7 black.

A drawing has been made three times from one of these, but from which is not known, the ball being replaced after the drawing, and every drawing has given a white ball. Required the chances in favour of each of these lotteries having been the one drawn from. If it had been the first, the chance of the event would have been 1 (or certainty); if it had been the second, the chance of the event would have been $\frac{4}{5}\times\frac{4}{5}\times\frac{4}{5}$, or $\frac{64}{125}$; if it had been the third, the chance would have been $\frac{2}{9}\times\frac{2}{9}\times\frac{2}{9}$, or $\frac{8}{729}$. The numerators of these fractions, reduced to a common denominator, are 91125, 46656, and 1000; whence the probability that the lottery drawn from was the first, is

$$\frac{91125}{91125+46656+1000},\text{ or }\frac{91125}{138781};$$

and the probabilities of the second and third lotteries are

$$\frac{46656}{138781}\text{ and }\frac{1000}{138781}.$$

The preceding question is well calculated to show the meaning of questions in this theory, which is thus seen to be applied to events, not because they are uncertain, but because they are unknown. As soon as the lottery is chosen, it is certain which it is, but since it is not known to the drawer, it is to him as much a contingency as it was before it was chosen.

6. When, in such a case as the preceding, it is required to know the probabilities of the events which may happen at any further trials, the probability of each lottery having been the one in question is to be multiplied by the probability of the new event arising from that lottery, and the results added together. Thus, suppose there are two lotteries, one having all white balls, and the other equal numbers of white and black balls; two drawings have been made from one of them (not known) and both drawings have given a white ball; what is the probability that a third drawing from the same lottery would give also a white ball? The chances for the two lotteries are found by the last to be $\frac{4}{5}$ and $\frac{1}{5}$, while the chances of a white ball from one and the other are 1 and $\frac{1}{2}$. It follows that $\frac{4}{5}\times 1+\frac{1}{5}\times\frac{1}{2}$, or $\frac{9}{10}$, is the chance of the third drawing giving a white ball.

7. If A or B must happen at every trial, and if in m trials nothing but A has happened, and if we know nothing whatever about the nature of preceding circumstances, then it is $m+1$ to 1 that A shall happen at the next trial, and $m+1$ to k that A shall happen throughout the next k trials. But if in $m+n$ trials A have occurred m times and B n times, it is $m+1$ to $n+1$ that A shall occur at the next trial.

8. Every event that can happen must happen if trials enough be made; and not only must happen, but must happen any number of times in succession. For example, if there be only one white ball to 100 black ones in an urn, and if drawings enough be made, the ball drawn being always returned and the urn properly shaken before a new trial, a person who goes on must at last draw that single white ball 1000 times running. This is a conclusion which the beginner cannot receive, particularly when he is told that 1,000,000 might be written for 1000, or any other number however high. Nevertheless, it will, in the course of his studies, not only be made clear to him, but it will also be shown that it is a conclusion which may be made obvious to common sense without any very profound mathematics.

9. If the odds against an event happening at any one trial be n to 1, there is an even chance of its happening in ·69 × n trials,* it is 10 to 1 that it happens in 2·40 × n trials, 100 to 1 that it happens in 4·62 × n trials, 1000 to 1 that it happens in 6·91 × n trials, and 10,000 to 1 that it happens in 9·21 × n trials. Thus if it be 200 to 1 against success in any one trial, 9·21×200 being 1842, it is 10,000 to 1 that there shall be one success at least in about 1842 trials. But if a person should make 1000 trials without one success, he would have no right to say that it is 10,000 to 1 in favour of one or more successes in the next 842 trials.

10. When any sum depends upon a contingent event, the present value of that sum is such a fraction of it as the probability of the event happening is of unity. Thus 20*l.* to be gained if an event happen against which it is 7 to 1, is now worth only the eighth part of 20*l.*

There are no questions in the whole range of applied mathematics which require such close attention, and in which it is so difficult to escape error, as those which occur in the theory of probabilities. This makes it difficult to lay down in a short space either maxims or examples sufficient to be really of use in advancing the student's progress; and of all subjects, there is no one in which writers of every grade have so frequently or so strangely made mistakes of mere inadvertence. One was pointed out a short time ago (*Camb. Phil. Trans.*) into which both Laplace and Poisson had fallen, one after the other; but the discoverer of their slip proved himself signally liable to greater ones a very little while after. (*Cab. Cyclop.*, 'Probability and Life Insurance,' p. 28.)

We shall conclude by a brief account of the historical progress of this branch of science; referring the reader for more detail to Montucla, and to the Treatise 'On Probability,' in the 'Library of Useful Knowledge.' Those who cultivated games of chance must at all times have had a general notion of combinations which were more probable than others, and must have seen that those cases of which there were most to happen, always did in reality happen most often. They could not fail to know, by reckoning on their fingers, that out of, for instance, all the throws of a pair of dice, there are only six doublets, and thirty other equally possible cases; nor could they have missed knowing that this must be the reason why doublets occur seldom in comparison with other throws. Notwithstanding this, the mathematical history of the subject usually dates from a fragment by Galileo, which merely shows why 10 can be oftener thrown on three dice than 9, and two problems proposed by Chevalier de Meré to Pascal, in 1654, concerning certain points connected with games of chance.

That the history of *correct* investigation dates from this period there can be little doubt, but the subject had been previously considered by Cardan, in a work, 'De Ludo Aleæ,' published from his manuscript in the first volume of the collected edition of his works, and never separately; and also so badly printed as to be almost unintelligible; circumstances both of which have probably contributed to keep it, as it has been kept, totally out of view. Cardan's theory is perfectly false: he supposes, for example, that since there are six faces to a die, it will happen in the long run that each face will come up once in six throws, which is true when many collections of six throws are averaged; but from this he draws the false conclusion that it is an even chance that any one face comes up in three throws. His numerical reasoning is therefore totally incorrect; but his notions on the general subject of probability are reasonably sound. Fortune, according to him, does not decide the general average of the play, but only the deviations on one side and the other which a small number of cases present; and experiment would, he says, prove that the long run would agree with the predictions of theory. This treatise was written about 1564, and published in 1663. But before this, in 1658, the tract of Huyghens, 'De Ratiociniis in Ludo Aleæ,' was published as an appendix to Schooten's 'Exercitationes Geometricæ,' being not only the first regular treatise, but the first which applies the theory to chances of loss or gain. It was translated into English, with additions, in 1692, the reputed author being Motte, the secretary of the Royal Society. Then followed the 'Analyse des Jeux de Hasard,' by Montmort (first edition 1708, second, enlarged, 1713), a work of higher mathematical pretensions. The 'Ars Conjectandi' of James Bernoulli, posthumously published by his nephew Nicolas, in 1713 (and which, it may be worth noting, is not contained in the collection of James Bernoulli's works), gives the first glimpse of the more difficult class of problems in which processes containing very large numbers are abbreviated by mathematical analysis. This was carried still further by De Moivre, whose first work, a paper 'De Mensura Sortis' (*Phil. Trans.*, 1711), was expanded into his celebrated treatise on the doctrine of chances, first edition 1718 (not 1716, as frequently stated), second edition 1738, third edition, with his 'Treatise on Life Annuities,' 1756. The next step was made by Bayes (*Phil. Trans.*, 1763 and 1764), who first considered the probability of hypotheses as deduced from observed events.

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* The number ·69, 2·40, &c., are all approximations.

The great work of Laplace (first edition 1812, third 1820) had in great part appeared at various previous times in the Memoirs of the Academy of Sciences. It is remarkable, first by the extension of methods which it furnishes, secondly by its giving at one view the whole state of the science and its applications, thirdly by the particular attention given to the application of the theory to the results of observation. [MEAN; LEAST SQUARES.] The next step in the history is Poisson's 'Recherches sur les Probabilités des Jugemens,' 1837, which gives the grand results of Laplace by a somewhat different analysis, and applies them particularly to the subject indicated in the title. This species of application had been before considered by Condorcet, in his 'Essai sur l'Application de l'Analyse à la Probabilité des Decisions,' Paris, 1785. It may also be worth while to mention the 'Traité de Calcul Conjectural' of Parisot, Paris, 1810, a work which deals largely in the theory of simple combinations. The elementary work of longest standing, which exhibits some view of the higher mathematical applications, is the 'Traité Elementaire du Calcul des Probabilités,' by M. Lacroix (second edition, 1822). The 'Essai Philosophique' of Laplace, which is an introduction to the third edition of his theory, contains no mathematics, and may be usefully read with any elementary treatise. The Instructions Populaires sur le Calcul des Probabilités,' by M. Quetelot, Brussels, 1828, contains the most elementary view of the subject, and uses only simple arithmetic.

In England, since the publication of Simpson's 'Laws of Chance,' 1740, and the 'Laws of Chance,' by Samuel Clark, 1758, little was written on the mathematical theory except so far as it had reference to life annuities and assurance, until a very recent period. About 1830, Messrs. Lubbock and Drinkwater published a tract 'On Probability,' in the 'Library of Useful Knowledge,' giving more general methods of applying modern algebraical investigation than had before appeared in this country. In 1837, the article 'Theory of Probabilities' in the 'Encyclopædia Metropolitana,' written by Mr. De Morgan, gave the results and methods of Laplace on most of the great questions of the theory. The 'Essay on Probabilities, and on their Application to Life Contingencies and Insurance Offices,' published by the same writer in the 'Cabinet Cyclopædia,' 1838, exhibits the principles without mathematical investigation and the results arranged in rules for use. The article on 'Probability' in the new edition of the 'Encyclopædia Metropolitana,' by Mr. Galloway, gives the mathematical investigation of the higher parts of the theory, following the methods of Poisson. This treatise is published separately.

On subjects connected with this article, see GAMING, RISK, WAGER, MEAN, LEAST SQUARES, OBSERVATION AND EXPERIMENT, WEIGHT OF OBSERVATIONS, ANNUITY, MORTALITY, REVERSION, &c.

PROBATE. [WILL.]

PROBLEM (*πρόβλημα*) means simply a thing put forward or proposed. In mathematical language it is anything which is required to be done, and in the earlier writers is distinguished from a theorem, or assertion to be proved, in that the latter does not require any specific object to be effected. Thus, 'all the angles of a triangle are together equal to two right angles' is to be shown or made evident, and is a theorem; but 'to draw a circle through three given points' presents an object to be effected, and is a problem. But it must be remembered that this difference lies more in the nature of the result than in the method; for the solution of this problem, so called, is an intuitive corollary from the theorem that if three points be joined, and perpendiculars be drawn bisecting two of the joining lines, the intersection of these perpendiculars is equidistant from the three points. It is also to be noted that this distinction of theorem and problem appears neither in the Greek of Euclid, Apollonius, nor Archimedes, the general term employed by all three, and in all cases, being *πρότασις*, which is translated by proposition. The distinction then is of a later date, and is the work of annotators: it appears in Pappus, according to the Latin of Commandine. It does not appear in the translation of Euclid by Athelard* (which goes by the name of Campanus); and the first edition of the Elements in which we find it is the subsequent edition of Zambertus. If we leave the modern followers of the old geometers, we find the word problem used in its simple etymological sense of something proposed; but for the most part employed when the something proposed contains, or has contained, a remarkable difficulty. Thus to this day we talk of the problem of three bodies, as being one the methods of which are hoped to be found capable of decided improvement. In algebra the word is variously used, though, according to the antient distinction, the solution of any equation of condition should be called a problem, and the establishment of any identity a theorem.

Perhaps the most correct use of the term is that of our own universities, in which questions proposed for examination are called problems when they are left entirely to the student to solve, not being to be found in the elementary treatises which he is supposed to have read. The adjective problematical is used in the sense of doubtful, but is not a mathematical term.

PROBOSCI'DIANS. [PACHYDERMATA, vol. xvii., p. 116.]

PROBUS, MARCUS AURE'LIUS, a native of Sirmium, served early in the Roman army, and distinguished himself so much that he was made tribune, whilst yet beardless, by the emperor Valerianus, who had great esteem for him, and who recommended him in his letters to his son Gallienus as a young man of great promise. Probus continued to serve with distinction under Gallienus, Claudius II., Aurelianus, and Tacitus. Several letters of these emperors, containing encomiums of Probus, are quoted by Vopiscus. Tacitus, immediately after his exaltation, wrote to Probus, saying that he considered him as the main prop of the state, and at the same time he gave him the command of all the legions in the East, with a large increase of emolument. Probus was beloved by the soldiers for the care which he took of them, and the equal justice which he administered. He served in almost every part of the Roman world—beyond the Danube against the Quadi and the Sarmatians, in Libya, in Egypt, where he erected buildings, excavated canals, and made other improvements; he fought against the Palmyrenians under Aurelian, and afterwards served in Gaul. When Tacitus died, six months after his assumption of the empire, his brother Florianus was proclaimed emperor in the West, whilst Probus was proclaimed in the East; but in less than three months Florianus was put to death by the soldiers, and Probus was acknowledged universal emperor. He was then forty years of age. He defeated several pretenders to the empire, Saturninus in the East, and Proculus and Bonosus in Gaul. He encouraged the cultivation of the vine in Gaul and in Pannonia, as well as in Mœsia near Sirmium. He is said to have incurred the displeasure of the soldiers by having said that he hoped shortly that universal peace being established over the empire, their services would no longer be required. An insurrection having broken out in his camp near Sirmium, he took refuge in an iron tower which he had constructed as a watch-tower, but being followed by the mutineers, he was killed, A.D. 282. He is compared by Eutropius with Aurelian for his military abilities, though he was superior to him in refinement and humanity. Vopiscus (*Historia Augusta*) has left a high eulogium of Probus. He reigned six years and four months, and was succeeded by Carus.

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* At the time when we published [GEOMETRY] our own unsupported opinion that Athelard, and not Campanus, was the translator, we did not know that Tiraboschi had already affirmed the same thing. Mr. Halliwell ('Rara Math.,' p. 57) makes it most probable that the commentary as well as the translation is Athelard's.

Coin of Probus.
British Museum. Actual size.

PROCACCINI, ERCOLE, the Elder, was the head of the celebrated family of artists of that name. He was born in 1520, at Bologna, where the greater number of his works still exist. Authors are divided in opinion respecting his merit; Baldinucci and Malvasia call him a painter of moderate talent, while Lomazzo esteems him to be a happy imitator of the colouring and grace of Correggio. His design may be too minute, and his colouring too languid, but he possessed far more taste than most of his contemporaries, and precision free from mannerism, which eminently qualified him for an instructor of youth. Several eminent artists, among whom were Sammacchini, Sabbatini, Bertoja, and his own three sons, were his disciples. The time of his death is uncertain, but he was living in 1591.

PROCACCINI, CAMILLO, born in 1546, received his first instruction in the school of his father. He afterwards visited Rome, where some biographers say that he studied the works of Michael Angelo and Raphael. His works evidently show that he had been charmed by Parmegiano. He combined a simplicity and spirit by which his works always charm the eye, though it must be owned that they are too often deficient in the higher power of impressing the mind and moving the affections, which indeed we can hardly expect when we consider the prodigious number of his works in Bologna, Ferrara, Ravenna, Reggio, Piacenza, Parma, and Genoa. Sometimes he allowed himself more time, and then his works have less of the mannerist. His St. Rocco at Reggio deterred Annibale Caracci from painting a companion to it. At Piacenza he had less success in painting against Ludovico; yet his picture occupies the principal place. He died in 1626.

PROCACCINI, GIULIO CESARE, the best artist of the family, was born in 1548. He renounced sculpture, in which he had made considerable progress, for painting, which he studied in the school of the Caracci. The works of Correggio were the principal object of his studies, and many judges are of opinion that no painter ever approached nearer to the style of that great artist. In some of his easel pictures and works of confined composition, he has been mistaken for Correggio. A Madonna of his, at S. Luigi de Franzesi, has been engraved as the work of that master; and some paintings still more closely approximating to this style are in the palace of Sanvitali at Rome and in that of Carrega at Genoa. Of his altar-pieces, that at Santa Afra in Brescia is perhaps most like the style of Correggio; it represents the Virgin and Child amidst a smiling group of saints and angels, in which dignity seems as much sacrificed to grace as in the mutual smile of the Virgin and the Angel in the Nunziáta at S. Antonio of Milan. He is sometimes blameable for extravagance of attitude, as in the Executioner of S. Nazario, which is otherwise a picture full of beauties. Notwithstanding the number and extent of his works, his design is correct, his forms and draperies select, his invention varied, and the whole together has a certain grandeur and breadth, which he either acquired from the Caracci, or, like them, derived from Correggio. He died in 1626, aged seventy-eight.

PROCACCINI, CARLO ANTONIO, brother of Camillo and Giulio, was born at Bologna, and learned the art from his father. Not having, like his brother, sufficient genius and invention to attain eminence in historical composition, he devoted himself to landscape, in which he acquired considerable reputation, as well as by fruit and flowers, which he designed after nature.

PROCACCINI, ERCOLE, called the Younger, was born in 1596, at Milan. He was the son of Carlo Antonio, and studied under his uncle Giulio Cesare. He frequently painted history and landscapes, but his chief excellence appeared in his flower-pieces, which he painted with great taste and perfection. He died in 1676, at the age of eighty.

PROCELLA'RIA. [PETRELS, vol. xviii., p. 46.]

PROCESS. This term is sometimes used in its original sense as comprehending the whole of the proceedings which take place, and are recorded by the court, in the course of a suit, criminal or civil, previous to final judgment. In this sense the word (processus, procès), is also used in the French, and the Scotch law. In its more ordinary and limited signification the term is applied to the writs which issue out of any court for the purpose of compelling the parties to a suit, and other persons whose co-operation is required, to do some act connected with the progress of the suit. In this sense also process is either civil or criminal.

Civil process was formally, and until lately, practically divided into original, mesne (intermediate), and final process.

Original process, more commonly known as original writs, issued out of the common-law side, or department, of the court of chancery, hence called the officina justitiæ, the shop at which the right of suing in the king's superior courts might be purchased. The price of this privilege was formerly arbitrary, and until the reign of John the render to the crown was more commonly stipulated for in hawks and horses than in money. But since Magna Charta, original writs have been purchasable at a small ad valorem fine of 10*s.* per cent. upon the amount sought to be recovered.

Mesne process was that which issued between the original writ and final judgment, including writs issued for the purpose of compelling the attendance of jurors and of witnesses, and for other collateral purposes. In order to avoid the expense and delay of suing out an original writ, it had long become usual to commence actions by mesne process founded upon a supposed original writ which never had in fact issued. By degrees all process before final judgment, except an original writ out of chancery, acquired the name of mesne process, even in cases where it formed the legal as well as the actual commencement of the suit, as in scire facias, auditâ querelâ, &c.

Final process comprehends writs of execution. [EXECUTION.]

Mesne and final process are sometimes called judicial process, because they issue under the authority of the judges of the court in which the action is pending. A great variety existed in the different forms of process by which actions were commenced in the three superior common-law courts, the inconveniences resulting from which are pointed out in the 'First Report of the Common-Law Commissioners,' presented in 1828, pp. 70 to 101, 121, &c., 132, &c. But now, by 2 Wm. IV., c. 39, it is enacted, that in actions brought in the courts of law at Westminster, the process shall be a writ of summons, in a form prescribed by the statute, which is addressed to the defendant, and requires him to cause an appearance to be entered within eight days from the service of the writ. If the writ be served on the defendant, and he does not enter an appearance, the plaintiff may direct his own attorney to appear for the defendant, and the defendant being actually or constructively in court by an appearance entered by himself or by the plaintiff for him, the action proceeds. If the defendant cannot be served with the writ of summons, a writ of distringas may be sued out, by which the sheriff is directed to distrain the defendant by his goods for the purpose of compelling an appearance, and if he still hold out, the plaintiff may cause an appearance to be entered for him.

Where the proceedings are against a trader who is a member of parliament, the writ of summons informs the defendant that an affidavit of debt for the sum of ....*l.* has been filed in the proper office, according to the provisions of the Bankrupt Act, 6 Geo. IV., c. 16, § 10, and that unless the defendant pay, secure, or compound for the debt, or enter into the bond, as provided by that act, and cause an appearance to be entered within one calendar month after service of the writ, he will be deemed to have committed an act of bankruptcy from the time of the service.

The act contains a provision for commencing actions where it was intended to have the security of the personal detention of the debtor, by writ of capias, if the defendant were at large, and by writ of detainer, if he were already in custody. But by 1 & 2 Victoria, c. 110, arrest upon *mesne* process (as it is called in the statute) is taken away, except in cases where an arrest is ordered by the court or a judge, and all actions must be commenced by summons, though if the court or a judge order an arrest, a capias may issue in the course of the cause already commenced by writ of summons.

By the operation of these statutes the writ of summons is the only process for commencing *personal* actions in the courts at Westminster. And by 3 & 4 Will. IV., c. 27, s. 36, all actions *real* or *mixed*, except writs of dower [DOWER], quare impedit [QUARE IMPEDIT], and ejectment [EJECTMENT], are abolished. These excepted actions may still be brought by original writ; which term is commonly confined to an original writ issuing out of chancery; the writ of summons, though really an original writ, not being in modern practice so designated.

By 2 & 3 Vict., c. 27, s. 3, all personal actions in borough courts are directed to be commenced by writ of summons.

Criminal Process.—Where an indictment [INDICTMENT] for treason or felony is found by a grand jury, process of capias issues to the sheriff, commanding him to arrest the indictee. But where an indictment found, or an information filed, charges the party with a misdemeanor only, the process is at common law a venire facias, being a command to the sheriff to cause the indictee, &c. to come into court, which, under this process, must be done by summoning him. If the indictee, &c. does not obey the summons, and it appears by the return that the indictee, &c. has lands in the county, a writ of distringas issues, commanding the sheriff to compel the indictee to appear, by distraining him by the issues (the produce) of those lands, to appear. If the return to the venire facias shows that the indictee has no lands, process of capias issues. And by 48 Geo. III., c. 58, s. 1, whenever any person is charged with any offence for which he may be prosecuted by indictment or information in the King's Bench, not being treason or felony, and the same shall be made to appear to any judge of the same court by affidavit, or by certificate of an indictment, or of information being filed, against such person in the said court for such offence, such judge may issue his warrant under his hand and seal, and thereby cause such person to be apprehended and brought before him or some other judge of the same court, or before some one justice of the peace, in order to his being bound, with two sufficient sureties, in such sum as the warrant shall express, with condition to appear in the said court at the time mentioned in the warrant, and to answer all indictments or informations for any such offence.

Before any indictment is found, a party charged upon oath with treason or felony may be brought before a magistrate by virtue of a warrant issued for his apprehension by the same or some other magistrate of the district, and may by another warrant be committed to prison for trial, if upon the examination there appear to be grounds to suspect that the party is guilty.

PROCESS-VERBAL (*Procès-verbal*) is a term derived from French jurisprudence, in which it signifies a memorandum or instrument drawn up and attested by officers of justice, containing a statement of the circumstances which have taken place upon the execution of a commission, upon an arrest, upon a precognition or preliminary examination of a party accused, or in the course of other legal investigations, and set forth in the order in which they have occurred. The term is now frequently applied to a contemporaneous detailed minute or note of any formal proceeding, though not occurring in the course of any legal inquiry, *e.g.* a note of the discussions which are taking place during the negotiation of a treaty, &c.

PROCHI'LUS. [BEAR, vol. iv., p. 90.]

PRO'CHYTA. [PROCIDA.]

PRO'CIDA, the antient Prochyta (Προχύτη, Strab.), is an island at the north-west entrance of the Bay of Naples, situated between the larger island of Ischia and Cape Misenum. Procida is about eight miles in circumference; it is generally level, with some gently rising grounds, and is fertile and well cultivated. The vineyards produce good common wine. The population exceeds 10,000; the men are mostly sailors and fishermen, and are reckoned among the most enterprising in the kingdom: many of them are engaged in the tunny and coral fisheries. The dress of the women bears some resemblance to that of the women of the Greek islands. The island contains several villages or hamlets, a small fort, and a royal palace or country-seat.

It was an old tradition (Strabo, pp. 60, 258), that Prochyta and Pithecusa were separated from Misenum by a violent convulsion of nature. (Compare Pliny, *Nat. Hist.*, ii. 88; iii. 6.)

PRO'CIDA, GIOVANNI DI. [ANJOU, DUKES AND COUNTS OF.]

PROCLAMATION. By the constitution of England, the king possesses the exclusive prerogative of issuing proclamations; for although this authority is exercised by the lord mayor in the city of London, and by the heads of some other corporations in other cities, for certain limited purposes, it is always founded upon custom or charter, and consequently only exists in such cases by delegation from the crown.

The nature and objects of royal proclamations are various. In some instances they are merely an authoritative promulgation of matters of state, or of acts of the executive government which it is necessary that all persons should know, and upon notice of which, as presumed to be conveyed by a public proclamation, certain duties and obligations attach to subjects. Proclamations of the accession of [illegible] new king or a demise of the crown, and proclamations for reprisals upon a declaration of war with a foreign state, and for rendering coin current within the realm, are examples of this kind. Another class of proclamations consists of those which declare the intention of the crown to exercise some prerogative or enforce the execution of some law which may have been for a time dormant or suspended, but which a change of circumstances renders it necessary to call into operation. Thus the king might, by a proclamation in time of war, lay an embargo upon shipping, and order the ports to be shut, by virtue of his antient and undoubted prerogative of prohibiting any of his subjects from leaving the realm. And there is no doubt that a breach of the duty imposed or declared by a proclamation of this kind would be punishable, either as a contempt, or as a misdemeanor at common law. Another and by far the most usual class of proclamations issued by the crown consists of formal declarations of existing laws and penalties, and of the intentions of government to enforce them, designed, as some of the early books term it, *quoad terrorem populi*, and merely as admonitory notices for the prevention of offences. A familiar instance of this kind of declaration is the proclamation against vice and immorality appointed to be read at the opening of all courts of quarter-sessions.

It is quite clear that at the present day the royal prerogative does not authorise the creation of an offence by proclamation which is not a crime by the law of the land; in the language of Sir Edward Coke (3 *Inst.*, 162), 'Proclamations have only a binding force when they are grounded upon and enforce the laws of the realm.' In early periods of our history after the Norman conquest, the power of the crown in this respect appears to have been much more extensive, and instances of proclamations may be found in Rymer's 'Fœdera,' and elsewhere, evincing an assumption of almost despotic authority by the crown. In the reign of Henry VIII. it was enacted, by the statute 31 Henry VIII., c. 8, that the king, with the advice of his council, might set forth proclamations under such penalties and pains as to them might seem necessary, which should be observed as if they were made by act of parliament; but this statute contained an express declaration that proclamations should not alter the law, statutes, or customs of the realm (Coke's *Reports*, part 12, p. 75), and was repealed about five years afterwards by the stat. 1 Edw. VI., c. 12. A strenuous attempt was made in the reign of James I. to strengthen the crown by increasing the prerogative of making proclamations, which, though encouraged and promoted by the lord chancellor Ellesmere and Bacon, were resisted by Coke, and occasioned great alarm and dissatisfaction among the people. The encroachments which had been made and attempted in this respect are enumerated and complained of in the 'Petition of Grievances' by the Commons, in 1610 (Howell's *State Trials*, vol. ii., p. 524); and in the same year it was expressly resolved by the judges (of whom Sir Edward Coke was one) that the king could not by his proclamation create an offence, which was not an offence before; 'for if so, he might alter the law of the land by his proclamation.' (Coke's *Reports*, part 12, p. 76.)

PROCLUS, a celebrated Neo-Platonist, was born at Constantinople, on the 8th of February, A.D. 412. His parents, who were people of wealth and consideration, resolved to give him the best possible education, and with this view sent him to Xanthus in Lycia, where he was taugh reading, writing, and grammar: thence to Alexandria, where he attended the lectures of all the most eminent teacher of philosophy and mathematics; and finally to Athens where he became a disciple of Plutarchus and Syrianus two distinguished philosophers of that school. Proclus wa the last rector of the Neo-Platonic school at Athens, and died there, A.D. 485, *i.e.* as his successor and biographer Marinus defines it, 124 years after the reign of Julian. (Marinus, *Vita Procli*, c. 36.) As the successor of Syrianus, he is sometimes called Diadochus.

The works of Proclus, which are very numerous, consist principally of commentaries on older writers; of these the best known are his commentaries on the 'Timæus' and 'Parmenides' of Plato, the latter of which has been recently printed as an appendix to Stallbaum's bulky edition of the dialogues. He wrote also commentaries on Hesiod's 'Works and Days;' on Ptolemy's 'Astrology;' and on the first book of Euclid's Elements,* in two books. His original works, besides a few hymns of doubtful merit, are a treatise 'On the Sphere,' published by Bainbridge, London, 1520 (which however is mostly taken from Geminus), and 'Eighteen Arguments against the Christians,' in which he endeavours to prove that the world is eternal.

In his style Proclus is much more perspicuous and intelligible than his predecessor Plotinus; indeed he is on the whole a good writer, and occasionally is almost eloquent. But the matter of his works has not much to recommend it: his propensity to allegorise everything, even the plainest and simplest expressions in the authors on whom he comments, must deduct largely from his merits as an expounder of other men's thoughts; and but for the interest which attaches to him as the last of a school of philosophy, it is not much to be regretted that his works have slumbered so long in the dust of libraries, and have been either wholly neglected or imperfectly edited. 'His life,' says Gibbon, 'with that of his scholar Isidore, composed by two of their most learned disciples, exhibits a deplorable picture of the second childhood of human reason.'

The commentaries on Euclid's first book are valuable for the large number of scattered pieces of information which they give on the history of geometry; but as commentaries they are only useful as showing what kind of discussion took place on geometrical questions at the time when they were written. These commentaries were translated by the late Mr. Thomas Taylor, whose attempts to revive all kinds of Platonism are well known. The original Greek was published by Hervagius at Basle, but from so bad a manuscript, that the Latin of Barocius (Patavii, 1560), taken from more and better manuscripts, is a better authority when it differs from the Greek of the Basle edition.

The reader who has any curiosity to know more of this author may refer to the following books (1) 'Procli Opera,' ed. Victor Cousin, Paris, 1820-27, 6 vols. 8vo.; (2) 'Initia Philosophiæ ac Theologiæ ex Platonicis fontibus ducta, sive Procli Diadochi et Olympiodori in Platonis Alcibiadem Commentarii,' ed. Fr. Creuzer, Francof. ad Mæn., 1820-25, 4 vols. 8vo: (3) 'Ex Procli Scholiis in Cratylum Platonis, ed. J. F. Boissonade, Lips., 1820; (4) Translation of the Six Books of Proclus on the Theology of Plato, &c., by Th. Taylor, Lond., 1815, 2 vols. 4to.; (5) 'The Commentaries of Proclus on the Timæus of Plato,' in 5 books, by Th. Taylor, Lond., 1820, 2 vols. 4to.

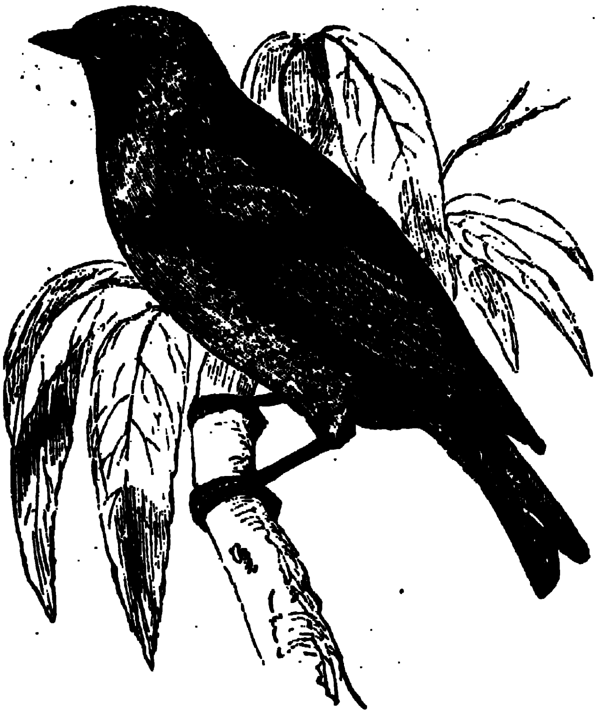
PRO'CNIAS, Count Hoffmansegg's name for a genus of birds placed by Mr. Swainson and others under the subfamily *Bombycillinæ*, Swallow Chatterers.

Generic Character.—Bill very broad; the sides inflected; the tip not hooked. Nostrils nearly naked. Wings pointed; the three first quills longest. Inner toe shorter than the outer. Tail slightly forked. (Sw.)

Example, *Procnias ventralis*, *Swallow Fruit-eater.*

Description.—(*Male.*)—Blue; front, throat, and temples black; middle of the body beneath white; the sides with blackish transverse striæ. Length about 5½ inches. *Female.*—Green; chin and temples grey; body beneath yellowish, transversely striated with dusky-green.

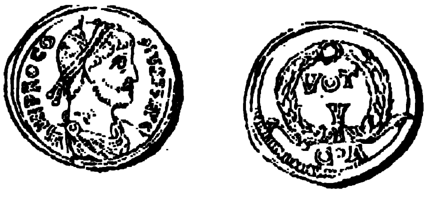
Mr. Swainson (*Zoological Illustrations*, 1st series) remarks that the birds of this genus are remarkable for the enormous width of their mouths, which in some species exceeds that of the Swallow family, thus enabling them with ease to swallow the large *Melastoma* berries and those of other tropical shrubs, on which alone they subsist; not on insects, as Cuvier asserts. Although, he adds, they perfectly resemble the swallows in the construction of their bills, their wings are not formed for rapid flight; and their feet are much stronger, and calculated for searching among branches for their food, in which situations Mr. Swainson frequently saw them. The species noticed is, he observes, a scarce bird; he met with it only three times in Bahia; but he says that it appears more frequent in the southern provinces of Brazil, specimens having been sent to him from Minas Geraes and Rio de Janeiro.



Procnias ventralis. (Sw., *Zool. Ill.*)

PROCONSUL. [CONSUL; PROVINCIA.]

PROCO'PIUS, ANTHE'MIUS, by which latter name he is best known in history, a grandson of Anthemius, who was minister of Arcadius and of Theodosius II., was proclaimed emperor of the West by the nomination of Leo I., emperor of the East, and with the consent of Ricimer, a chief of Suevian and other barbarian mercenaries in the service of the empire, who had assumed the supreme military authority over Italy after the death of Severus. As a condition of his consent, Ricimer obtained the hand of the daughter of Anthemius. After a few years Ricimer quarrelled with his father-in-law, and marched against him. The emperor Leo dispatched the patrician Olybrius to Italy to mediate a peace, but Olybrius, being offered the crown by Ricimer, was tempted by the offer and accepted it. Anthemius, though forsaken by most of his followers, made a stout resistance outside of Rome, but he was defeated and killed, A.D. 472, after five years' reign.



Coin of Procopius.

British Museum. Actual size.

PROCO'PIUS was born at Cæsarea in Palestine, about the end of the 5th or beginning of the 6th century. After studying rhetoric in his native country, he went to Constantinople, where he gave lessons on rhetoric, and appears to have practised also as a lawyer, for such he is styled in the title of some of his works. His reputation for learning and ability reached the court; and the emperor Justin the Elder, in the last year of his reign, appointed him assessor (συγκάθεδρος) to Belisarius, who was about that time sent as governor to Dara on the frontiers of Armenia. Procopius afterwards accompanied that commander in his first war against the Persians (A.D. 530), afterwards in that against the Vandals in Africa (533-5), and lastly against the Goths in Italy (536-9). During these campaigns he appears to have rendered himself very useful through his abilities and activity, and to have been entrusted by Belisarius with important commissions connected with the service of the army. In his capacity of assessor, he was the general's legal adviser, and he was also his private secretary. In the year 538, he assisted Antonina, the wife of Belisarius, in raising troops in Campania, and in sending some by sea to Rome, which was then besieged. On his return to Constantinople, about the year 540, the emperor Justinian made him a senator, as a reward for his services. In 562, he was made prefect of Constantinople; unless perhaps it was another of the name who obtained this dignity in the year 562. He died in that city at an advanced age, but the precise year of his death is not ascertained.

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* In ASTRONOMY, p. 532, for 'Proclus Diadochus (not the commentator of Euclid), A.D. 550, read 'Proclus Diadochus (the commentator of Euclid), A.D. 450.'

Procopius wrote the 'History of his own Times,' in eight books, which has been translated into Latin by Claude Mattret, a jesuit. 'Procopii Cæsariensis Historiarum sui Temporis Libri Octo,' fol. Paris, 1662, with the Greek text. The work has also been translated into Italian, German, and other modern languages. There is a German translation, with notes, by Kanngiesser, Greifswald, 1827-29, 3 vols, 8vo. The 'History' of Procopius is an important work, which forms the connecting link between antient and modern history, between Ammianus Marcellinus and the Byzantine historians. Procopius was well informed and unprejudiced; he was a spectator of, or an actor in, most of the events which he narrates; he was well acquainted with the court of Justinian; and he is generally trustworthy, except perhaps where he stoops to the customary flatteries towards the emperor, the empress Theodora, and his patron Belisarius, for which flattery however he has made ample amends in his secret history of the same personages. His descriptions of the manners of the various barbarous nations which invaded the Roman empire are vivid and interesting. The first two books of his history concern the Persian wars. He begins his narrative with the death of Arcadius, and briefly relates the wars between the Romans and Persians under Theodosius the Younger, Anastasius, and Justinus, and lastly Justinian. As he comes down to contemporary times, his history is more diffuse. He brings his narrative down to the 23rd year of Justinian's reign, A.D. 550. Books 3 and 4 treat of the wars of the Vandals in Africa, and the reconquest of that province by Belisarius. The 5th, 6th, and 7th books are concerned with the history of the Gothic kingdom in Italy founded by Theodoric, and the expedition of Belisarius against Totilas. The 8th book is of a mixed character; it resumes the account of the Persian wars, then speaks of the affairs of the Roman empire in other quarters, in Africa, on the Rhine, and in Thrace, and at last it resumes the narrative of the Gothic war in Italy, the expedition of Narses, the defeat and death of Teia, and the final overthrow of the Gothic kingdom.

A second volume, published likewise at Paris, in 1563, contains two other works of Procopius, in the Greek text, with a Latin translation. One contains an account of the public buildings erected or restored by Justinian throughout the empire, 'De Ædificiis Domini Justiniani Libri VI.' It is written in a laudatory style, but contains much valuable topographical information.

The other work of Porcopius is entitled 'Anecdota, or Secret History,' in thirty chapters. The character of this book has been noticed under JUSTINIANUS. Justinian and Theodora are here painted in the darkest colours. Procopius says that he wrote it to complete his 'History,' in which he could not, through fear of torture and death, speak of living persons as they deserved. Some grossly obscene passages concerning Theodora, who was evidently a very bad woman, have been expunged in most editions. There seems little doubt that Procopius is the author of the work. The Paris edition of Procopius, already quoted, is enriched with copious historical notes, prefaces, and an index.

PROCTOR, an officer of the Ecclesiastical courts, whose business is that of an agent between his clients and the courts to which he is attached. He stands in a similar situation to that of an attorney at common law, or a solicitor in chancery. There are about 120 proctors now practising in the several courts of Doctors' Commons, London, which are four in number, the Court of Arches, the Prerogative Court, the Consistory or Consistorial Court of the Bishop of London, and the Admiralty Court.

In commencing a suit in any of these courts, the proctor is appointed by a proxy executed by the client, by which he constitutes him his agent, and promises to confirm all his acts as by law required in such suit. The proctor then proceeds to collect the facts of the case, and to apply to the court, in his client's behalf, to draw allegations and interrogatories, and summon witnesses, whose evidence is taken down in private by the examiners, who are proctors appointed for that purpose. This evidence is deposited in the registry of the court in which the suit is brought, and is not allowed to be seen by any party until such time as the court may think fit to order publication. No *vivâ voce* evidence is received in these courts. After the necessary information has been collected and arranged, the proctor prepares his client's case, to be put into the hands of the advocates, to be by them brought before the court, if they deem it advisable.

In the case of wills, or administrations with the will annexed, that is, where the deceased has left a will, but has not appointed any executor, the executors or administrators are sworn to the due execution of the will of the deceased; and they make affidavit as to the amount of property, time of death, &c. The proctor then makes a copy of such will or papers, and places it before the registrar of the court to be compared with the original; the copy, when thus compared, is returned to him with the probate under seal of the court attached. In cases of administration, he delivers in a formal account of the claims of the parties who apply for letters of administration, with an affidavit as to the value of the property and other particulars, and prays the court to decree letters of administration also under seal of the court. These instruments are then delivered to the executors or administrators, and are their authority for distributing the property of the deceased according to his will, or, in the absence of a will, according to law.

It is also the business of the proctor to obtain licences for marriage, on the application of either of the parties about to contract such marriage, and to draw an affidavit in which the party applying for the licence declares that he or she knows of no legal impediment to such marriage. It is the proctor's duty to explain the nature of this affidavit to his client, who is then sworn to the truth of it before one of the advocates, who are appointed surrogates, or deputies of the judge. The affidavit is then lodged in the Faculty Office, or office of the vicar-general, and licence obtained under seal: this licence remains in force for three months.

The proctor in many cases has to attest the acts of his client, and for this purpose he is appointed a notary public, but his power as such extends only to proceedings in his own courts, and not to the general business of a notary. The official title of a proctor is 'notary public, and one of the procurators-general of the Arches Court of Canterbury and of the High Court of Admiralty.'

The number of the proctors is prevented from increasing very rapidly by the restrictions on taking 'clerk apprentices:' only the thirty-four senior proctors, and of them only such as are of five years' standing in such seniority, are allowed to take an articled clerk, and in no case to take a second until the first has served five years, and then only by permission of the court. The term of articleship is seven years, which is legally required on account of the notarial capacity in which they have to act. Notwithstanding these regulations, the number has materially increased. In the time of Charles II. there were only thirty-four procurators-general and ten supernumeraries. The proctors wear a gown as a badge of office in court, and in the Arches a cape trimmed with ermine in addition; and on certain occasions, such as upon admission or attending prayers on the first day of Term, a wig similar to that of a barrister. They are exempted from serving as jurors or parish officers.

The appeal from these courts is to the Judicial Committee of the Privy Council, where the proctor conducts the case in the same way as in the courts of Doctors' Commons, but is obliged to call to his assistance a barrister, in addition to an ecclesiastical advocate. There is an appeal court held in Doctors' Commons, but it is only for business preliminary to the cause being heard before the Privy Council.

The courts are held in the common hall of Doctors' Commons, situated in the College, in which are the official residences of the judges and advocates. The proctors have no inn, or regular locality, but are very inconveniently dispersed about the narrow streets near the College.

Attached to the courts of the province of York and to the different bishops' courts are similar bodies of proctors, who differ only in trifling circumstances from those here described. [PROCURATOR.]

PRO'CULUS, one of the tyrants or pretenders to the empire who rose after the death of Tacitus. He was a native of Liguria, and originally a chief of robbers, but afterwards served in the army with distinction under Aurelian, and showed himself a brave though rude soldier. He was proclaimed emperor in Gaul, and fought against the Germans, but being attacked by Probus, who was acknowledged emperor by the senate, was defeated and killed, A.D. 276. (Vopiscus, *Historia Augusta.*)

PROCURA'TOR, a manager or agent, whence the word proctor is formed.

A Roman procurator was a person appointed by another to manage or conduct a cause for him. It required no particular words to constitute a man a procurator; nor was it, as in the case of a cognitor, necessary for the opposite party to consent to his appointment. A man might commence a suit as a procurator, without showing his authority; but it seems that he was obliged to produce it before the judges came to a decision, or to enter into security that the plaintiff would abide by his acts. (Gaius, iv. 84.)

Under the Empire the governor of a province was, in certain cases, called a Procurator, or Procurator Cæsaris. Sometimes this Procurator had not the government of a province, but only managed affairs of revenue (res fisci). [PROVINCIA.]

PRO'CYON. (Astronomy.) [SIRIUS AND PROCYON.]

PRO'CYON. (Zoology.) [RACCOON.]

PRO'DICUS, a native of Cos, or, as some think, of Chios, flourished B.C. 435. He was a disciple of Protagoras, became a celebrated Sophist, and had among his followers Socrates, Euripides, Isocrates, and Xenophon. Prodicus travelled through Greece from town to town, to deliver his lectures, for which he demanded payment of his hearers, sometimes to an extravagant amount. Several antient writers refer to these lectures, or harangues, as worthy of a philosopher. Prodicus however is reported to have been put to death by the Athenians, because they thought that he corrupted the youth by his teaching; and it is further remarkable that he is numbered among the atheists by Cicero (*De Nat. Deorum*, i. 42). None of the writings of Prodicus are extant except a beautiful episode preserved by Xenophon (*Mem.*, ii. 1), usually called 'The Choice of Hercules.' This has been paraphrased in English verse by Shenstone and by Bishop Lowth; and there is a prose translation in the 'Tatler.' Three others of this name are noticed by Fabricius, but very little concerning them is known. (Fabricius, *Bibliotheca Græca.*)

PRODUCT, a term really equivalent to result, but used only when the result is the one obtained by the multiplication of two or more quantities.

PROFANENESS. [BLASPHEMY.]

PROFESSION, PROFESSED. [MONK.]

PROFIT, one of the three parts into which all that is derived from the soil by labour and capital is distributed, the other two being wages and rent: from these three sources arise all the revenues of the community. Profit is therefore the surplus which remains to the capitalist after he has been reimbursed for the wages advanced and the capital consumed during the process of production. To obtain this surplus is the only object for which capital is employed.

Profits have a tendency to fall to the same level in all branches of industry; for if the ratio of profit in proportion to the capital employed be greater in one than in another, more capital will be directed to that which affords the highest profit; and the powers of production being increased, the supply is greater, prices fall, and the equilibrium of profit is restored. A distinction must however be made between real and apparent profit. When the employment of capital is attended with extraordinary risk, profits are nominally high; but after deducting the losses to which it is exposed, the real profits tend to the same level as the ordinary rate. The case is similar in occupations of a disagreeable or agreeable nature, the pleasantness of the latter counterbalancing the low rate of profit. A wholesale merchant and a retail trader both dealing in the same commodities may appear to obtain different rates of profit; but in the latter case wages are confounded with profits, and when they are properly distinguished, the apparent disproportion is diminished. Unless we reduce profits from their apparent to their real value, there is no truth in the maxim that the rate of profit is uniform in the same country at the same time. In different stages of society the rate of profit is subject to certain changes. In all new countries the employment of capital is attended with large returns, and profits are high. As population advances, it becomes necessary to cultivate land of inferior degrees of fertility, or to apply more capital to the land already cultivated. The labourer receives a greater proportional share of the produce, though it may be less absolutely than before this change took place; and more capital being necessary to obtain the same quantity of produce, the proportion of profit to the capital employed is therefore less: that proportion of the produce which is distributed as rent increases.

The natural tendency then of profits (whether arising from capital employed in agriculture or in manufactures) is to decline as the necessities of the population render it necessary to have recourse to inferior soils. Happily, improvements in machinery and in the art of agriculture, better combinations of labour and capital, and greater freedom of commerce, are calculated to arrest this retrograde movement; and to such sources of relief every highly advanced country must look as a means for sustaining its prosperity; for whatever diminishes the necessity of raising food from the poorer soils, tends to maintain the rate of profit.

Two other causes have great influence upon the rate of profit, namely, wages and taxation. A rise in wages will diminish profits, unless industry becomes more productive; but if the latter take place, both may rise at the same time, either in the same or in different proportions according to circumstances.

Taxation will diminish profits, unless wages fall or industry become more productive. Taxes on profits, when they fall alike upon all capital engaged in productive industry, are paid by the owners of capital, who have not the power of charging the tax upon consumers. Consumption is checked and the power to accumulate diminished. When the profits of only certain classes of traders are taxed, they would betake themselves to other occupations not taxed, unless they could charge the consumers with the tax: the tax therefore falls upon the consumers.

The effect of the competition of capitalists in reducing the rate of profit has not been much discussed by writers on political economy. Mr. M'Culloch says:—'Competition cannot affect the productiveness of industry, and therefore has nothing to do with the average rate of profit.' In reply to this assertion it has been remarked (*Edin. Rev.*, No. 142, p. 443) that although the inferior fertility of newly cultivated soils be the immediate cause of the diminution of the rate of profit, yet it is nothing but the competition of capitalists which drives capital to seek the inferior soil, and induces its owners to be content with a lower rate of profit. The capitalists who had accumulated at the old rate of profit are content with a new investment producing a lower rate, instead of consuming their savings unproductively.

(Ricardo, *Principles of Political Economy and Taxation*, chaps. v. and xiii.; Mill, *Elements of Political Economy*, c. ii., sec. 3; and c. iv. sec. 6; M'Culloch's ed. of the *Wealth of Nations*, note vii.; *The Laws of Wages, Profits, and Rent investigated*, by Professor Tucker, Philadelphia, 1837.)

PROGNO'SIS (in Medicine) is the opinion formed respecting the probable future events of any disease, as, for example, whether it will terminate in recovery or in death how long it is likely to continue, what other diseases may be expected to arise in its course, what are the chances of relapse, and what those of some permanent injury of structure or function being produced by the morbid processes.

PROGRESSION. A series of numbers following any law should be called a progression, but the word is usuall restricted to two sorts of progression, which are called, but by no means correctly, arithmetical and geometrical: the analogies pointed out in RECTANGLE give the origin of these terms.

An *arithmetical progression* is one in which the terms continually increase or diminish equally, including, as an extreme case, that in which they do not increase nor diminish at all. Thus

7, 7, 7, 7, &c. 7, 8, 9, 10, &c.
10, 9½, 9, 8½, &c. 2, 3¼, 4½, 5¾, &c.

are sets of terms in arithmetical progression. The following proposition contains the principal part of their theory:—

If a be the first term of an arithmetical progression, and Δa the difference between any two terms (negative, if the terms diminish); and if a_n be the nth term from and after *a exclusive*, and S^n the sum of n terms, we have

$$a_n = a + n\,\Delta a;$$

$$S_n = na + n\frac{n-1}{2}\,\Delta a.$$

From these two equations between a, n, a_n, Δa, and S_n, any three of these being given, the other two can be found, subject however to this restriction, that the problem is unmeaning when n is not a whole number, whether it be given or found. These theorems are only the simplest case of a more general pair, in which, taking any series, and supposing neither the differences nor the differences of the differences, &c. to be equal, an expression is given for any term of a series, or for the sum of n terms, which frequently gives finite forms in the place of indefinite ones. Calculate, as in the article DIFFERENCE, the value of Δa, $\Delta^2 a$, &c., from a, a_1, a_2, &c., and let

$$n_1 = n, \quad n_2 = n\frac{n-1}{2}, \; n_3 = n\,\frac{n-1}{2}\,\frac{n-2}{3}, \text{ \&c.}$$

Then
$$a_n = a + n_1\Delta a + n_2\Delta^2 a + n_3\Delta^3 a +, \text{ \&c.}$$
$$S_n = n_1 a + n_2\Delta a + n\ \Delta^2 a + n_4\Delta^3 a +, \text{ \&c.}$$

Thus in the series $1 + 5 + 17 + 43 + 89 + 161 +$ &c., the law of whose terms is undiscoverable at first sight, we shall, by what the beginner may, till he knows better, call an accidental circumstance, discover both the law of the terms and that of their sum, as follows:—

$$\begin{array}{llllll}
1 & & & & & \\
 & 4 & & & & \\
5 & & 8 & & & \\
 & 12 & & 6 & & \\
17 & & 14 & & 0 & \\
 & 26 & & 6 & & 0 \\
43 & & 20 & & 0 & \\
 & 46 & & 6 & & \\
89 & & 26 & & & \\
 & 72 & & & & \\
161 & & & & &
\end{array}
\qquad
\begin{array}{l}
a = 1,\ \Delta a = 4,\ \Delta^2 a = 8,\\
\Delta^3 a = 6,\ \Delta^4 a = 0,\ \Delta^5 a = 0,\\
\text{\&c.}
\end{array}$$

$$a_n = 1 + 4n_1 + 8n_2 + 6n_3 = n^3 + (n+1)^2$$
$$S_n = n + 4n_2 + 8n + 6n_4$$
$$= \left(n\frac{n-1}{2}\right)^2 + \frac{n(n+1)(2n+1)}{6}.$$

Thus the seventh term (the sixth after 1, $n = 6$) is $6^3 + 7^2$, or 265, and the sum of 6 terms (make $n = 6$ in the second formula, in which remember that S_n is the sum of n terms, not of n terms after a) is $(\frac{1}{2}.6.5)^2 + \frac{1}{6}.6.7.13$, or 316, which may easily be verified. [SUM.]

The apparently accidental circumstance above alluded to, is the vanishing of all the differences of a from and after the fourth. But it is to be observed, that the series was originally constructed so as to make all differences vanish after the fourth, and that the preceding theorem will never change indefinite into definite formulæ, except when all differences after a certain one vanish. The rule is, when a_n is an algebraically rational and integral function of n of the p order, that is, of the form $kn^p + ln^{p-1} +$, &c., all differences after the pth vanish, and then only.

Geometrical progression is when the terms of a series increase or diminish by the use of the same multiplier, whole or fractional, including, as an extreme case, that in which the multiplier is unity. Thus, the multipliers being 1, $\frac{8}{7}$, $\frac{1}{2}$, and 2, the four following sets of terms are in geometrical progression:—

$$7,\ 7,\ 7,\ 7,\ \text{\&c.} \qquad 7,\ 8,\ \tfrac{64}{7},\ \tfrac{512}{49},\ \text{\&c.}$$
$$3,\ \tfrac{3}{2},\ \tfrac{3}{4},\ \tfrac{3}{8},\ \text{\&c.} \qquad 9,\ 18,\ 36,\ 72,\ \text{\&c.}$$

If a be the first term, and b the second, the nth term is $a\,(b \div a)^{n-1}$, and the sum of n terms is

$$\frac{a^n - b^n}{a^{n-2}\,(a-b)} \quad\text{or}\quad \frac{b^n - a^n}{a^{n-2}\,(b-a)},$$

according as a is greater than or less than b. But when $a = b$, the sum is of course na. If $b \div a = r$, that is, if the terms be a, ar, ar^2, ar^3, &c., the nth term is ar^{n-1}, and the sum of n terms is

$$a\,\frac{1-r^n}{1-r} \quad\text{or}\quad a\,\frac{r^n-1}{r-1},$$

according as r is less than or greater than one. If r be less than one, the series of terms, however far it may be carried, never reaches $a \div (1-r)$, though it may approach this limit with any degree of nearness by making the number of terms sufficiently great.

Thus the following equations,

$$2 = 1 + \tfrac{1}{2} + \tfrac{1}{4} + \tfrac{1}{8} + \tfrac{1}{16} + \text{\&c.}$$
$$1 = \tfrac{2}{3} + \tfrac{2}{9} + \tfrac{2}{27} + \tfrac{2}{81} + \tfrac{2}{243} + \text{\&c.}$$

though always erroneous, stop where we may, yet can be brought as near to truth as we please by writing down terms enough on the second side. In the use of the word INFINITE, as explained in the article on that subject, we may then say that the above equations are absolutely true, if the series be carried *ad infinitum*. The general equation, made absolutely true, after stopping at ar^n in the series, is

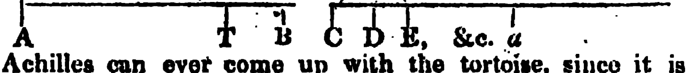
$$\frac{a}{1-r} = a + ar + \ldots + ar^n + \frac{ar^{n+1}}{1-r}.$$

Other points connected with this equation will be mentioned in the article SERIES.

There is no doubt that every whole can be subdivided into parts without limit, or, in common language, can be divided into an infinite number of parts. An old fallacy, mentioned in MOTION, receives its explanation from the preceding. If we make $a = 1 - r$, the equation carried *ad infinitum* becomes

$$1 = (1-r) + (1-r)r + (1-r)r^2 +, \text{ \&c., } \textit{ad. inf.}$$

By giving different values to r, we have therefore an infinite number of ways of subdividing unity into an infinite number of parts. If then we take a problem in which an antecedent is followed by a consequent; and if dividing the antecedent into an infinite number of parts, we consider separately the parts of the consequent which belong to those of the antecedent, we shall of course divide the consequent into an infinite number of parts. It would be a gross fallacy to infer that the consequent must be infinitely great, because it is produced in a never-ending succession of parts, since that never-ending succession was produced by dividing the avowedly finite antecedent into an infinite number of parts. No one could fail to detect the following: 'Let M be divided into an infinite number of parts, a, b, c, &c.; let each of these parts be doubled; then the result is made up of $2a$, $2b$, $2c$, &c., *ad infinitum*; consequently $2a + 2b + 2c +$, &c., being made up of an infinite number of quantities, is infinite.' Nevertheless this fallacy was not only produced in an ingenious form, as a sophism [MOTION], but has even reappeared in modern times as a serious argument. The sophism is known by the name of 'Achilles and the Tortoise.' The swiftest of men runs after the slowest of beasts, without (says the sophism) the possibility of ever overtaking it. For if, when they set out, Achilles be at A and the tortoise at T, then by the time Achilles has run over AT, how fast soever he may run, the tortoise will have gone over some length, say TB; while the hero goes over TB, his dinner (for dinner he may have out of it, in spite of the sophism) goes over BC, and so on *ad infinitum*. How then, asks the objector, is it possible that Achilles can ever come up with the tortoise, since it is unquestionable (and this is perfectly correct), that let him go as far as he may, he must always come up to where the tortoise was before he can reach the point at which he is; so that it requires *an infinite number of parts of time* (but here the sophism quietly introduces *an infinite time*) to catch the tortoise? The answer is, that Achilles will certainly overtake the tortoise at a finite distance from A, say at a: any contrivance which subdivides Aa into an infinite number of parts, does the same with the time in which Achilles runs over Aa; and there is no more reason to say that the time is therefore infinitely great, than to say that Aa is made infinitely great by the subdivision. This would be a sufficient answer, since it would throw upon the sophist the *onus* of showing that the infinite number of parts of time makes an infinite time; but a more complete answer consists in positive proof that it is not so, as follows:—



Let AT be called a, and let Achilles move m times as fast as the tortoise; then TB is necessarily the mth part of AT, BC of TB, CD of BC, &c. Hence, if t be the time in which Achilles moves over AT, this time, added to his times of going over TB, BC, CD, &c., or t, $t \div m$, $t \div m^2$, &c., make up

$$t\left(1 + \frac{1}{m} + \frac{1}{m^2} + \frac{1}{m^3} + \frac{1}{m^4} +, \text{ \&c., } \textit{ad inf.}\right)$$

Now if m be greater than 1 (for unless Achilles move faster than the tortoise, it is admitted he can never catch it), the series above named is $1 \div \left(1 - \frac{1}{m}\right)$, so that the whole time is $tm \div (m-1)$, and the whole length Aa is $am \div (m-1)$, the same answer as would be produced by common methods. The sophism divides this length into the infinite number of parts

$$a \qquad \frac{a}{m} \qquad \frac{a}{m^2} \qquad \frac{a}{m^3} \qquad \text{\&c.;}$$

and taking the times due to each,

$$t \qquad \frac{t}{m} \qquad \frac{t}{m^2} \qquad \frac{t}{m^3} \qquad \text{\&c.,}$$

assumes the sum of the latter to be infinite.

In the work of a celebrated political economist there is the following argument, to show that a tax on wages must fall on the labourers; for if it did not so fall, wages would rise, whence the price of goods would rise, which would again cause a rise of wages, and this again a rise in goods, and so on *ad infinitum*, which is inferred to be absurd. This is of course precisely a repetition of the preceding case; and granting all the premises, the conclusion by no means follows. For that conclusion is that the rise would go on without limit, which need not be the case.

PROHIBITION, a writ to prohibit a court and parties to a cause then depending before it from further proceeding in the cause. It will be convenient to define,—1, out of what courts it may issue; 2, to what courts it may be addressed; 3, under what circumstances it is grantable; 4, at whose instance it may be obtained; 5, at what time it may be obtained; 6, the form and incidents of the proceeding.

1. A writ of prohibition may issue from any of the three superior courts of common law at Westminster, and also from each of the common-law courts of Chester and Lancaster. It is generally stated that a writ of prohibition may issue from the Court of Chancery; but the Court of Chancery acts by injunction addressed only to the parties, and does not interfere with the court. [INJUNCTION.]

2. It may be addressed by any of the three superior courts to any other temporal court; such as to the Admiralty courts, to courts-martial, a court baron, any other inferior court in a city or borough, to the Cinque-Ports courts, the duchy or county palatine courts, the chancery of Chester, the Stannary courts, the Court of Honour of the Earl-Marshal, to the Commissioners of Appeals of Excise, to any court by usurpation without lawful authority, or to a court whose authority has expired. When any one has a citation to a court out of the realm, a prohibition lies to prevent his answering. It seems also that it might issue to the Court of Exchequer and to the Court of Common Pleas; but not to the Court of Chancery, nor is there any instance of a prohibition to the King's Bench. It may be granted by any of the three superior common-law courts to any spiritual court, and by the common-law courts of Chester and Lancaster to the spiritual courts within the county palatine and duchy.

3. The writ is grantable in all cases where a court entertains matter not within its jurisdiction; or where, though the matter is within its jurisdiction, it attempts to try by rules other than those recognised by the law of England. Matter may be said to be not within the jurisdiction of a court in two senses: 1, when the subject-matter entertained is in its nature not cognizable by the court; 2, where the subject-matter is in its nature cognizable by the court, but lies out of the local district where only that court has jurisdiction; or, in the case of a court whose jurisdiction is general, when the subject-matter lies in a local district exempt from the general jurisdiction of the court or where the subject-matter of the cause relates to persons over whom the court has no jurisdiction.

In order to ascertain those cases which fall under the first head, we must consider the nature and character of the subject-matters over which the jurisdiction of the court extends. It is obvious, that if we have those clearly defined, we shall see whether the subject-matter in question is or is not within that jurisdiction. This general rule may be useful, because the cases that may occur in which a prohibition will lie, are endless. The examples of cases which have occurred will assist in the application of it. To begin with those relating to temporal courts. A prohibition will lie if one sue another in a court-baron, or other court not a court of record, for charters concerning inheritance or freehold; or in the county court for trespass vi et armis; or in the county courts or courts baron for a matter of 40*s*. or upwards,—and the plaintiff cannot evade the prohibition by dividing his demand into smaller sums; to the courts of Admiralty, if they entertain questions of a contract made or to be executed within the kingdom; to an inferior court, if an action be brought in it on a judgment in one of the superior courts; to the court of honour of the earl-marshal, if it holds plea of things determinable by the common law. To a spiritual court a prohibition will lie, if it takes cognizance of any plea concerning a title to lands or tenements, or an advowson of a church, or an office, or goods, money, or chattels; and this applies even in the case of goods or ornaments given to a church, or matters of a criminal nature punishable only temporally: in short, as it has been said, anything for which a remedy exists at common law. Yet it has been held that a pension which commenced by the grant of the patron or ordinary may be sued for either in the temporal or spiritual court. Lord Coke however goes further, and says that prohibition lies to a spiritual court in any case, though of a spiritual nature, where a remedy is given by statute in a temporal court, unless the jurisdiction of the spiritual court is saved by the same statute. Perhaps this assertion cannot be maintained to the full extent. In some cases it has been so held, as where a suit in an ecclesiastical court was instituted for preaching without licence or marrying without banns, these having been created offences by act of parliament. Still a prohibition does not lie in a suit for small tithes or for contribution to the repairs of the church, though other remedies are given in these cases by statute (7 and 8 Wm. III., c. 6, and c. 34), and perhaps in some other cases. In cases where no remedy exists elsewhere, a spiritual court may still be restrained from entertaining questions as to matters not within its jurisdiction.

With regard however to the spiritual courts, various exceptions and restrictions must be applied to what has been said. A spiritual court can hold plea for goods, money, and chattels to which a spiritual character attaches; as for instance, tithes, provided they are under a fourth part of the value of the church, or oblations, mortuaries, &c., that is, payments by communicants, or payments for marriages, christenings, churchings, and burials, or pensions; or a sum promised to be given as a marriage portion. It can also hold plea for matters testamentary, such as a legacy, even of a chattel real. Though a will disposes of land as well as personalty, the granting of probate belongs to the spiritual court; but this grant in no way determines the validity of the will so far as relates to the land. A spiritual court has also jurisdiction as to offices merely spiritual, but not for lay offices, even though they are in the spiritual court. It has also jurisdiction over offences committed within the spiritual court itself, as perjury or extortion in all officers of the court, or for brawling and committing a nuisance within a churchyard, or for defamation where no damages are demanded, or where a crime either merely or in part spiritual is imputed, or the words spoken are mere words of passion. Where violence has been done to a spiritual person, he may maintain a suit in the ecclesiastical court, to punish the party by ecclesiastical censures. The spiritual court also has cognizance of a suit for maintaining a way to the church, or where the question is not of a right of way generally, but solely as to the right of way to a church, or a way by which a parson carries off his tithes.

Prohibition lies equally both where the matter of the suit is not cognizable by the court, and where, though the substance is cognizable, matter arises during the progress of it, and is clearly about to be tried, over which the court has no cognizance. As to this, perhaps some confusion and contradiction will be found in the authorities. It has been said that where a suit is brought in the spiritual court for a thing within the cognizance of that court, and temporal matter becomes *incident*, it shall be determined there, and there can be no prohibition. (12 Co., 65.) However this must always have been understood with the condition, that as to such things the ecclesiastical court was bound to try according to course of common law. Perhaps it was only applicable to cases where parties neglected to apply for prohibition till after sentence, and where no want of jurisdiction appeared on the face of the proceedings. More recent cases have clearly established that if in a cause properly cognizable by a spiritual court a question arises and is necessarily about to be tried as to the existence of a custom, or a prescription, or the limits of a parish, or where in a suit for tithes there is plea of a modus, or that the lands are discharged by statute, or tithes are claimed of things for which no tithes are due, or the defendant makes title by lease, &c., a prohibition will lie immediately.

It has been laid down broadly that the ecclesiastical courts cannot try any matter triable at common law. It is otherwise however where the construction of a statute may come in question: prohibition will not lie on the mere suggestion that the spiritual court is not competent to construe it.

A prohibition is in all cases grantable where a court allows illegal or disallows legal evidence, as where the commissioners of appeals for the excise determine by the minutes of evidence taken by a justice of the peace, instead of examining the witnesses *vivâ voce*, or a spiritual court disallows proof of payment, &c. because proof of it is made only by a single witness, or where it has misconstrued an act of parliament, or disallows an award when it is good by law.

Where a suit is for matter within the cognizance of the court, which is combined with things over which the court has no cognizance, prohibition will issue as to that over which the court has no cognizance. But in those cases where both parties to the suit are spiritual persons, as where the question is whether the tithes belong to the rector or the vicar, no prohibition lies.

Where the matter is cognizable by the court, but lies out of its local jurisdiction, the question is merely one of boundary; as in cases where an inferior court holds plea of matter out of its limits, the duchy courts or courts palatine of land out of the duchy, &c. This is also the case where one spiritual court trespasses on the district of another, as if a man resident in one diocese or peculiar be cited to appear in another; in this case it is however to be observed that no prohibition will lie if the proper ordinary refuses or neglects to act in the case, or is party to the suit, or, under certain circumstances provided for by the canons, refers the matter to his immediate superior.

A prohibition will also lie where a court attempts to extend its jurisdiction to parties over whom it has none, as where a court-martial inquires into the conduct of a person not a soldier or sailor; the Stannary courts, where neither parties are tinners, nor the matter in question respecting tin, &c.

4. A prohibition may be obtained at the instance of either party to an ecclesiastical suit. In the case of a suit for tithes against a lessee, it may be obtained by the reversioner. Where a court has no jurisdiction over the matter of the suit, a prohibition is grantable at the request of a mere stranger.

5. If a court has no cognizance of the matter of a suit, prohibition will lie immediately after appearance, and it may be obtained by either plaintiff or defendant at any future time, even after sentence, appeal, and affirmation; or after judgment and execution, provided it appears by the libel, or by the libel and the proceedings, that the court had no jurisdiction. Where the court has cognizance of a cause, prohibition will not lie until the matter out of its jurisdiction has not only arisen, but is also clearly in progress of being tried. If that matter is then admitted by the litigant parties, the court is still entitled to entertain cognizance of the suit. If not admitted, and these circumstances, though not appearing on the face of the proceedings, are duly brought forward before sentence, a prohibition will then lie. If however a prohibition is not then applied for, but the party submit to the trial in the court where the suit has been commenced and sentence is pronounced, no prohibition will lie unless it appear on the libel, or the libel and the proceedings, not only that matter out of the jurisdiction of the court has arisen, but also that the matter has been wrongly decided. (Gould *v.* Gapper, 5 East, 345; Byerly *v.* Windus, 5 B. & C. 1.) If a spiritual court has cognizance of part of the charge and not of the rest, the court will not grant a prohibition after sentence. In cases where the suit is determined, it would appear that those observations can at all events only apply to permanent courts, and where something still remains to be done. In the case of an occasional court, as a court-martial, it would be impossible to carry the principle into execution.

6. A writ of prohibition is applied for by motion in court, which sets out the proceedings in the suit. If the proceedings are not sufficient to show the want of jurisdiction in the court against which prohibition is prayed, suggestions must be added, verified by affidavit, showing such want of jurisdiction.

If the court grants a rule, the other party is heard in answer. The court may then decide, either to refuse the prohibition, or, if they incline to grant it, direct the party applying to declare in prohibition. The mode of doing this is regulated by 1 Will. IV., c. 21. The declaration must contain a concise statement of the grounds of the application, and conclude by praying that the writ may issue. To this the other party may demur on the ground that no sufficient cause appears for a prohibition, or he may plead such matters as he thinks proper to show that the writ ought not to issue, and conclude by praying that it may not issue. If matters of fact are put in issue, they are tried by a jury. Judgment is given either on the demurrer or after nonsuit or verdict. The party succeeding is entitled to the costs of these proceedings, and, if a trial takes place, the jury may assess damages. If the court decide in favour of the party applying, the writ issues and forbids the court and other party from further proceeding. In such case, if the ground of application was that the court had no jurisdiction at all in the suit, the writ of prohibition is final. But, if the ground is that something had arisen not cognizable by the court, during the progress of a suit, concerning a matter properly within its jurisdiction, the prohibition is not final. In such case the question is referred to the proper tribunal for trial, and if found against the applicant, the suit may be then resumed. In either case, where the court decides in favour of the party against whom prohibition is prayed, or the verdict has been afterwards in his favour, the court awards a consultation, as it is called, by which the cause is again remitted to the original court. If parties proceed after a writ of prohibition has been obtained and served, they are liable to an attachment for contempt. No prohibition for the same matter lies after a consultation has been awarded upon the merits.

(Comyns's *Digest;* Bacon's *Abridgment;* Viner's *Abridgment;* tit. 'Prohibition,' 2 *Inst.*, 599; 3 Bl. *Com.*, c. 7.)

The right of the common-law courts to issue writs of prohibition, and the mode in which they exercised that right, have often been the subject of great dispute between the common-law judges and the ecclesiastics. The latter have several times exhibited many articles of grievance before the parliament and privy council against the former. The most famous of these are the 'Articuli cleri,' exhibited by Archbishop Bancroft, in the name of the whole clergy, in the third year of the reign of James I. They are given at length by Lord Coke (2 *Inst.*, 599), with a full view of the nature of the controversy between the parties, and the unanimous answers of the judges.

PROITHERA. [Night-Jars, vol. xvi., p. 229.]

PROJECTILES, THEORY OF. This subject usually comprehends the investigation of the relations between the space described, the time of motion, and the velocity acquired by a body when impelled in any direction by some motive force.

The circumstances of a body descending from a high place towards the earth by the action of gravity, and those of a body projected vertically upwards from the earth, on the supposition, in both cases, that the body moves in a non-resisting medium, have been noticed in the article Fall of Bodies; and the circumstances attending the motion, both in a resisting and a non-resisting medium, of a body impelled by fired gunpowder, when the impulse is in a direction parallel or oblique to the horizon, have been investigated in the article Gunnery. It is intended therefore in this place only to consider the laws of the vertical ascent and descent of bodies in resisting media, the force of gravity, or of terrestrial attraction, being supposed to be constant; and in non-resisting media, under the condition that the force of gravity is variable.

Let a spherical body descend vertically from a state of rest in a resisting medium (air, water, &c.) supposed to be of uniform density; and let it be admitted, agreeably to the Newtonian hypothesis (*Princip.*, lib. ii., sec. 1; *Schol.*), that the resistance of the medium is proportional to the square of the velocity, v, acquired at any moment in the descent; then, if we suppose U to be the velocity which a body falling towards the earth in the resisting medium would acquire when that resistance becomes equal to the accelerative force of gravity, the latter being, as usual, represented by g (= 32·2 feet), we shall have $U^2 : g :: v^2 : \frac{v^2}{U^2}g$; and the last term represents the resistance of the medium at the instant when the velocity is v; hence the accelerative force by which the falling body is urged at such moment is expressed by $g - \frac{v^2}{U^2}g$.

Now s being the space descended by the body in the time t, and v being the velocity as before, an accelerative force is represented by $\frac{dv}{dt}$ and by $\frac{d^2s}{dt^2}$. [Force.] Therefore $\frac{dv}{dt} =$

$g-\frac{v^2}{U^2}g$; whence $g\,dt=\frac{dv}{1-\frac{v^2}{U^2}}$; and integrating this equation, observing that $v=0$ when $t=0$, we have $t=\frac{U}{2g}$ hyp. log. $\frac{U+v}{U-v}$, or $\frac{2gt}{U}=$ hyp. log. $\frac{U+v}{U-v}$; or again, passing from logarithms to numbers, $\frac{U+v}{U-v}=e^{\frac{2gt}{U}}$ (e being the base of the hyperbolic logarithms); whence $v=U\frac{e^{\frac{2gt}{U}}-1}{1+e^{\frac{2gt}{U}}}$, and this second member being developed, gives $v=gt-\frac{g^3t^3}{3U^2}+$&c. Substituting, in this equation, $\frac{ds}{dt}$ for v, and again integrating, we have $s=\frac{1}{2}gt^2-\frac{g^3t^4}{12U^2}+$ &c.

These equations for s and v give the space descended and the velocity acquired at the end of any given time t from the moment when the motion commenced. For tables of the values of U (the terminal velocities) for iron balls, see Dr. Hutton's 'Tracts,' tract 37.

Next, let a body be projected vertically upwards in a uniformly resisting medium with an initial velocity $=V$; and let the body be of a spherical form so that U may be the same as before: then, the force of gravity and the resistance of the medium acting in a direction opposite to that of the projectile force, we have now $\frac{dv}{dt}=-g-\frac{gv^2}{U^2}$; whence $-g\,dt=U\frac{d.\frac{v}{U}}{1+\frac{v^2}{U^2}}$. This equation, being integrated, gives $-gt=U$ arc tan. $=\frac{v}{U}+$ *const.*; and considering that $v=V$ when $t=0$, the constant is equal to $-U$ arc tan. $=\frac{V}{U}$; putting $-C$ to represent this term, we have $\frac{C-gt}{U}=$ arc tan. $\frac{v}{U}$; and passing from arcs to tangents, we have $\frac{v}{U}=$ tan. $\frac{C-gt}{U}$, or $v=U$ tan. $\frac{C-gt}{U}$. Multiplying both members of the last equation by dt, and putting dx for its equal $v\,dt$, this equation becomes $dx=U$ tan. $\frac{C-gt}{U}dt$; which integrated gives $x=\frac{U^2}{g}$ hyp. log. cos. $\frac{C-gt}{U}+$ *const.* The constant is determined by considering that $x=0$ when $t=0$; whence *const.* $=-\frac{U^2}{g}$ hyp. log. cos. $\frac{C}{U}$: therefore $x=$

$$\frac{U^2}{g}\text{ hyp. log. }\frac{\cos.\frac{C-gt}{U.}}{\cos.\frac{C}{U}}$$

Making $v=0$ in the above equation for v, we get the value of t when the body has attained its greatest height; and substituting the value of t so found in the last equation for x, we have that greatest height.

When arrived at the greatest height, the body would begin to return towards the earth; and it may be shown that the velocity acquired by the body on arriving at the place from whence it was projected would be less than the initial velocity; also that the time of the descent would differ from the time of ascent.

If we imagine the earth to be perforated in the direction of a diameter; and if a body be allowed to descend towards the centre in a non-resisting medium from any point in the line of perforation: the law of attraction being in such a case directly proportional to the distance of the body at any time from the centre of the earth (Newton, lib. i., prop. 73), the relation between the space descended and the time of descent may be thus investigated.

Let r be the radius of the earth, and let the force of gravity at the surface be represented by g; then x being any distance from the centre, the attracting force acting on the body at that distance will be $\frac{gx}{r}$. Therefore since the distance of the body from the centre diminishes, while the time reckoned from the moment of departure increases, we shall have $\frac{d^2x}{dt^2}=-\frac{gx}{r}$. This equation will be found to be verified by assuming $x=a$ cos. $t\sqrt{\frac{g}{r}}+b$ sin. $t\sqrt{\frac{g}{r}}$; which being differentiated once, gives $\frac{dx}{dt}=-a\sqrt{\frac{g}{r}}$ sin. $t\sqrt{\frac{g}{r}}+b\sqrt{\frac{g}{r}}$ cos. $t\sqrt{\frac{g}{r}}$. Now, in the equation for x, making $x=r'$ (any given distance from the centre) when $t=0$, we have $a=r'$; and in the equation for $\frac{dx}{dt}$, making $\frac{dx}{dt}$ (the velocity) $=0$ when $t=0$, we have $b=0$. Consequently $x=r'$ cos. $t\sqrt{\frac{g}{r}}$; whence x is found when t is given: but when $x=0$, we have $t\sqrt{\frac{g}{r}}=\frac{\pi}{2}$ (where π represents the half circumference of a circle whose radius is equal to unity) whatever be the value of r'. Therefore $t=\frac{\pi}{2}\sqrt{\frac{r}{g}}$ will express the time of falling from the surface to the centre of the earth.

Let it now be required to investigate the relations between the times, the spaces described, and the acquired velocities when a body falls in vacuo from a point at such a distance from the earth that the attraction of gravity upon it may be considered as variable; and when, agreeably to the law of nature, its intensity is *inversely proportional* to the square of the distance. (*Princip.*, lib. i., prop. 74.) Then, if r be the radius of the earth, p the distance from the centre of the earth to the point above the latter from whence the body is let fall; and if x be the space descended in any time t: also if g be the force of gravity at the earth's surface, we shall have $\frac{1}{r^2}:g::\frac{1}{(p-x)^2}:\frac{r^2g}{(p-x)^2}$; and the last term expresses the force of gravity at the place of the body when the space descended is x and the time of descent is t: therefore $\frac{d^2x}{dt^2}=\frac{gr^2}{(p-x)^2}$.

In order to integrate this equation, multiply both sides of it by $2dx$; and then the first integral will be $\frac{dx^2}{dt^2}=\frac{2gr^2}{p-x}+$ *const.* The constant may be found on considering that $\frac{dx}{dt}$ (the velocity) $=0$ when $t=0$, when also $x=0$; therefore *const.* $=-\frac{2gr^2}{p}$, and $\frac{dx^2}{dt^2}=2gr^2\left(\frac{1}{p-x}-\frac{1}{p}\right)$; whence $\frac{dx}{dt}=\sqrt{\left\{\frac{2gr^2}{p}.\frac{x}{p-x}\right\}}$. This equation may be put in the form $\frac{(p-x)\,dx}{\sqrt{px-x^2}}=\frac{2gr^2}{p}dt$; and by the rules of integration we have $t\sqrt{\frac{2gr^2}{p}}=\sqrt{px-x^2}+\frac{1}{2}p$ arc cos. $=\frac{p-2x}{p}$: there is no constant to be added, because $x=0$ when $t=0$. From this equation t may easily be found when x is given: likewise from the equation for $\frac{dx}{dt}$ we have the velocity when x is given. And if x be made equal to $p-r$, the whole distance of the body from the surface of the earth, we shall obtain the whole time of the descent and the velocity acquired at the end of that time.

Again: let it be supposed that a body may be projected vertically upwards in vacuo from the surface of the earth, and be subject to a variably accelerative force of attraction upwards. Let r be the [illegible] of the earth, as before, and [illegible] from the surface at the [illegible] height due to the initial [illegible] quired [illegible] with a uniformly accelerating [illegible] the square of that velocity [illegible] law of attraction we have $\frac{1}{r^2} : g :: \frac{1}{(r+x)^2} : \frac{gr^2}{(r+x)^2}$; and the last term expresses the intensity of the attractive force at the end of the time t from the commencement of the ascent. Hence $\frac{d^2x}{dt^2} = -\frac{gr^2}{(r+x)^2}$.

In order to integrate this equation, multiply both sides by $2dx$; then we get $\frac{dx^2}{dt^2} = \frac{2gr^2}{r+x} + const.$: and to find the constant, it must be observed that $x=0$ when $\frac{dx^2}{dt^2} = 2gh$; therefore $const. = 2g\,(h+r)$ and $\frac{dx^2}{dt^2} = 2g\,(h+r) - \frac{2gr^2}{r+x}$, or $= \frac{2g\{hr+(h+r)x\}}{r+x}$. Taking the square roots and transposing, we have $\frac{\sqrt{r+x}}{\sqrt{\{hr+(h+r)x\}}}dx = \sqrt{2g}\,.\,dt$, and this equation may be put in the form

$$\frac{(r+x)dx}{\sqrt{\{hr^2+(2h+r)rx+(h+r)x^2\}}} = \sqrt{2g}\,.\,dt,$$

or (h being small compared with r) rejecting h when added to r, the equation becomes

$$\frac{(r+x)dx}{\sqrt{\{hr^2+r^2x+rx^2\}}} = \sqrt{2g}\,.\,dt.$$

Now, multiplying the numerator and denominator of the first member by $2r$, and putting the whole in the form

$$\frac{(r^2+2rx)dx}{2r\sqrt{\{hr^2+r^2x+rx^2\}}} + \frac{r\,dx}{2\sqrt{\{hr^2+r^2x+rx^2\}}} = \sqrt{2g}\,.\,dt,$$

the rules of integration give

$$\frac{1}{r}\sqrt{\{hr^2+r^2x+rx^2\}} + \frac{\sqrt{r}}{2}\,\text{hyp log}\left\{\frac{r^{\frac{3}{2}}}{2} + x\sqrt{r} + \sqrt{\{hr^2+r^2x+rx^2\}}\right\} + const. = \sqrt{2g}\,.\,t$$

The constant may be determined by considering that $x=0$ when $t=0$; and thus t may be found when x is given.

What has been stated respecting the vertical descent and ascent of bodies may be understood to apply also to bodies descending and ascending on inclined planes; the force of gravity on the plane being represented by g sin. a, where a is the inclination of the plane to the horizon.

In Dr. Hutton's Tracts there is given a problem for determining the height ascended by a ball when projected vertically upwards with a given velocity, and resisted by the the air; the force of gravity being supposed to be constant, and allowance being made for the decrease in the density of the air as the ball ascends. (*Tract* 37, prob. v.) In the same tract there is also given (prob. xi) an investigation of the circumstances attending the motion of a body in air when projected horizontally on a smooth surface so that the action of gravity may produce no effect on the motion of the body, the resistance varying as the square of the velocity. Also in Poisson's 'Traité de Mécanique,' the following remarkable circumstance is demonstrated:—If a body be projected, as in the last case, and if the resistance of the air vary as the square root of the velocity; the motion of the body will at first diminish gradually till it becomes equal to zero, and afterwards it will go on increasing indefinitely. (Tom. i, no 136, ed. 1833.) But for the demonstrations of these problems our limits oblige us to refer the reader to the works just mentioned.

PROJECTION. The practical parts of this most important application of geometry are noticed in the articles MAP, PERSPECTIVE, GNOMONIC, GLOBULAR, ORTHOGRAPHIC, STEREOGRAPHIC, MERCATOR, &c. The present article is merely intended to point out the general principle of all projections, and also to note the theoretical importance of the subject.

Imagine a surface of any kind, through every point of which passes a curve the character of which depends upon that point, insomuch that, given a point of the surface, the curve which passes through that point is given. If any second surface be taken, which is cut by all the curves [illegible] from the points of the first, every point of the first surface has a point corresponding to it on the second. Thus if the curve passing through A on the first surface cut the second surface in a, the point A is said to be projected on the second surface at a by means of the projecting curve Aa. Similarly any line on the first surface is projected into a line on the second, which last contains the projections of all the points on the first; and the projections of the several boundaries of a figure on the first surface are boundaries of a figure on the second, which is the projection* of the first figure.

It is not perhaps usual to make so wide a definition of projection in general, since the only cases which are commonly considered are those in which the projecting lines are all straight, and either parallel to one another, as in the orthographic projection, or all passing through the same point, as in common perspective. But such a conception of projection is necessary: in Mercator's projection, for example, the points of a sphere are projected on a circumscribing cylinder, not by straight lines passing through a point, but either by straight lines disposed according to a complicated law, or by curves. If a relation between any point and its projection be given, so that either can be found from the other, the passage from one to the other may be made either on a straight line or on an infinite variety of curves: but it may happen that the law which the disposition of the projecting straight lines follows may be of a more difficult character than that which would be required if a curve, not in itself so simple as a straight line, were substituted.

When the foundations of plane geometry were fixed, and the first principles of solid geometry were superadded, it was natural that the very simple idea of the perspective projection should excite attention. In a country in which the first principles at least of drawing were practically known, the following problem must have suggested itself to the geometers: If through a given point lines be drawn through all the points of the boundary of a plane figure, until they are stopped by another plane, required the figure traced out upon the second plane. A straight line was known thus to give a straight line: a moment's consideration of the circle, the only other line then considered, would show that a projection of a circle and a plane section of a cone are the same things. Hence probably the first idea of a conic section, and thus, if the conjecture be correct, the attention was turned from that point, which would, if properly kept in view, have led to the theory of projections in place of one isolated branch of it. The properties of the conic sections, as deduced in the antient manner from the cone, are neither so general nor so easy as they might be made, and it may be confidently expected, considering the progress which the doctrine of projections has made of late years, that the method of considering the ellipse, hyperbola, and parabola as projections of the circle, will become established in elementary teaching, in preference to the detached geometrical and algebraical methods now in use.

We have already spoken of the geometry of projections [GEOMETRY, p. 156]. unfortunately there is no elementary work which gives a general view of its first principles, and until such a work shall appear, the student must search for himself the writings of Monge, Carnôt, Chasles, Poncelet, &c. The 'History of Geometry, by M. Chasles, referred to in the article cited, will furnish many more references, and the 'Propriétés Projectives des Figures,' by M. Poncelet, is perhaps the work in which the student may most easily make an advantageous beginning of the subject.

The basis of the theory of projections must be the investigation of properties which, being true of a figure, are therefore true of its projections. Some of these are evident enough: thus the projection of an intersection of two lines is the intersection of its projections; if two curves touch one another, their projections touch at a point which is the projection of the point of contact. But the following property, which is projective, that is, true of the projections of every figure of which it is true in the first instance, will give a good idea of the facility with which certain properties of the conic sections may be deduced from the circle.

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* The projection of a line or figure has seldom any other name; in astronomy however the projection of a planet's distance from the sun on the plane of the ecliptic is sometimes called the *curtate* distance.

Let there be any figure in which the product of certain straight lines is equal to, or in any absolutely given ratio to, the product of certain others, each line being denoted by an initial and terminal letter in the usual way. We might say, in more geometrical language, let there be any number of ratios which, compounded together, give either a ratio of equality or a given ratio. Two simple conditions being fulfilled, this property will be as true of the projections as it is of the figure itself. These conditions are, first, that every initial and terminal letter shall occur the same number of times on both sides of the equation; secondly, that for every line on the first side, there shall be a distinct line on the other side, which is in the same straight line. For example (the reader may draw the diagram for himself), let each of the sides of the triangle ABC cut one circle, namely, AB in P and Q, BC in R and S, CA in T and V; the order of the points being APQBRSCTVA. Then by the properties of the circle, it is easily seen that

$$\mathrm{AV.\,AT.\,CS.\,CR.\,BQ.\,BP} = \mathrm{AP.\,AQ.\,BR.\,BS.\,CT.\,CV.}$$

In this equation, A, B, and C occur twice on each side, and each of P, Q, R, S, T, once. Moreover, out of AB there are two segments, AP and AQ, on the first side, and as many, BQ and BP, on the second; and the same of BC and CA. He then who is acquainted with the theory of projections, immediately knows that this property is true of any projection of a circle, or of any conic section: but he would be an energetic algebraist who should attempt to prove this (or still more the equally demonstrable similar property in the case of a polygon of *n* sides) by the common algebraic methods.

The proof of the preceding general *projective* property is not difficult. Take a point O outside the plane for the centre of projection, and let $\mathrm{OA} = a$, $\mathrm{OB} = b$, &c.; moreover let the angle made by a and b be called (ab). Let A′, B′, &c. be the projections of A, B, &c., let $\mathrm{OA}' = a'$, $\mathrm{OB}' = b'$, &c., and let $(a'b')$ be the angle of a' and b', which is $= (ab)$. Moreover let [AB] mean the perpendicular let fall upon AB from O, &c. It is then easily proved that

$$\mathrm{AV} = \frac{a\,v.\,\sin\,(av)}{[\mathrm{AV}]},\ \mathrm{AT} = \frac{a\,t.\,\sin\,(at)}{[\mathrm{AT}]},\ \&c.$$

Substitute these values in the equation, and it will be readily seen that the existence of the two conditions above named amounts to all the quantities except the sines of the angles being eliminable by division. There remains then

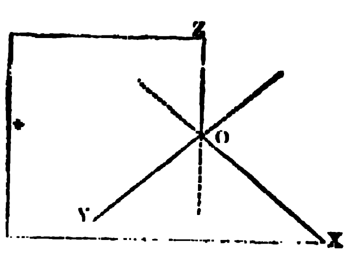
$$\sin\,(av).\ \sin\,(at).\ \&c. \quad = \quad \sin\,(ap).\ \sin\,(aq).\ \&c.$$
$$\text{or } \sin\,(a'v').\ \sin\,(a't').\ \&c. = \sin\,(a'p').\ \sin\,(a'q').\ \&c.$$

In this write a', b', [A′V′], &c. where there were previously a, b, [AV], &c., which will amount (by the conditions) to multiplying both sides by the same quantities: there will then remain an equation which is obviously

$$\mathrm{A'V'.\ A'T'.}\ \&c. = \mathrm{A'P'.\ A'Q'.}\ \&c.,$$

and in the same way any other case may be proved.

PROJECTION OF MATHEMATICAL DIAGRAMS. The diagrams by which mathematical students (and even writers) represent their solid figures are generally so imperfect, that it may be worth while to explain how, in all cases of sufficient importance, a good drawing may be made with very little trouble. The demonstration may be found in the 'Cambridge Mathematical Journal,' No. 8, p. 92. The projection is supposed to be the Orthographic, in which the eye is at an infinite distance, and all parallels are projected into parallels, &c.



Let OX, OY, OZ, be the intended projection of the three axes of co-ordinates, the dark lines being supposed to belong to that quarter of space in which lies a line drawn to the eye from the origin O. Each of the angles YOZ, ZOX, XOY, is then greater than a right angle. The following table contains numbers sufficiently near for the purpose, proportional to the square roots of the sines of twice the angles written in the opposite columns.

90°—180°	000	105°—165°	707	120°—150°	931
———	132	———	718	———	935
91—179	187	106—164	728	121—149	940
———	229	———	738	———	944
92—178	264	107—163	748	122—148	948
———	295	———	757	———	952
93—177	323	108—162	767	123—147	956
———	349	———	776	———	959
94—176	373	109—161	785	124—146	963
———	396	———	793	———	966
95—175	417	110—160	802	125—145	969
———	437	———	811	———	972
96—174	456	111—159	818	126—144	975
———	474	———	826	———	978
97—173	492	112—158	834	127—143	980
———	509	———	841	———	983
98—172	525	113—157	848	128—142	985
———	541	———	855	———	987
99—171	556	114—156	862	129—141	989
———	571	———	869	———	991
100—170	585	115—155	875	130—140	992
———	599	———	882	———	994
101—169	612	116—154	888	131—139	995
———	625	———	894	———	996
102—168	638	117—153	900	132—138	997
———	650	———	905	———	998
103—167	662	118—152	911	133—137	999
———	674	———	916	———	999
104—166	685	119—151	921	134—136	1000
———	696	———	926	———	1000
				135—135	1000

The lines between the degrees are to be understood as representing half degrees: thus opposite to 991 should come 129½°—140½°. The use of this table is as follows:—suppose the angles YOZ, ZOX, XOY, to be severally 123°, 104½°, and 132½°: thus:—

YOZ = 123°	956	x
ZOX = 104½°	696	y
XOY = 132½°	998	z

Opposite to the angles put down the numbers belonging to them in the table, and opposite to each number the co-ordinate whose capital letter does not appear in the angle. Then opposite to x, y, and z, we have 956, 696, and 998. These numbers show the proportions which the projections of equal lines bear to one another on the three axes. Thus a foot parallel to x is to a foot parallel to y, as 956 to 696 in the projection. If then a card be taken, and the angle ZOX be cut out; and if a slit be made in the direction of OY, just wide enough to permit a pencil to travel, scales of equal parts may be laid down on OX, OY, and OZ, which shall represent the projections of equal lines in the three directions; and this may be done once for all. It would be easy enough to make a general scale by which the equal parts proper for any angle should be taken out at once.

The isometrical perspective of Professor Farish [Perspective, p. 492] is the simplest case of this, namely, that in which the angles are each 120°. The only difference between this particular case and any other is, that the former requires only one scale of equal parts, whereas the latter requires either two or three. In other respects this method of using them is precisely the same.

PROJECTION OF THE SPHERE, SHADOWS, &c. [Perspective.]

PROKOPHIEV, IVAN PROKOPHIEVITCH, an eminent Russian artist, was born at St. Petersburg, January 25, 1758. At the age of twelve he began to study sculpture under Gilet, one of the professors at the Academy of Fine Arts, and during the eight following years obtained medals and prizes for various bas-reliefs, to which branch of the art he afterwards more especially applied himself. Having gone through the course of studies at the academy, he was sent, at its expense, in September, 1779, to perfect himself under Julien, at Paris, where, in the following year, he executed a bust in marble of Prince Gagarin, and a relief in terra-cotta representing Moses, which last, and a similar one of Morpheus, are in the Academy at St. Petersburg. Having passed a few months at Berlin and Stettin, on his way home, he returned to Petersburg in the summer of 1784; and from that time till within a few years preceding his death, he continued to practise his art most industriously. His productions are so numerous that even a mere list of them would extend to a considerable length; but the majority of them were certainly not of the kind to excite much public attention, as they consisted chiefly of bas-reliefs, medallions, and works of that class, on a comparatively small scale, and executed for private individuals. Many of them besides were only in terra-cotta. Taken generally however they are allowed to display considerable powers of invention and ability in composition. In the Imperial Library at Petersburg there are sixteen small caryatides and twenty-eight bas-reliefs by him. His last work was a bust of the Polish poet Trembecki; soon after the completion of it he was attacked by a complaint that deprived him of the use of his right hand, at least rendered him incapable of employing it either in modelling or designing. He died at St. Petersburg, February 10, 1828, in his 71st year.

The earlier productions of this artist have, with much beauty, somewhat also of the French mannerism of that day in sculpture, caught, no doubt, from his instructor Julien; but he afterwards completely corrected that fault, and his later works display a more noble and classical style.

PROLOCU'TOR. [Convocation.]

PROLOGUE (*πρόλογος*, from *πρὸ*, *before*, and *λόγος*, *speech*) is usually applied in English to the short poem or verses which are sometimes prefixed to new plays to recommend them to the favour of the reader or spectators. In the comedies of Plautus and Terence we find prologues of this kind. Aristotle (*De Poetic.*, c. 12) gives the name of prologue to that part of the Greek tragedy which precedes the Parodos, or first speech of the chorus.

PROMERO'PIDÆ, PRO'MEROPS. [Upupidæ.]

PROME'THEUS (Προμηθεύς). The story of Prometheus takes different forms in the Greek legends, but they agree generally in representing the close connection between him and the human race. He is represented by Æschylus as one of the Titans, who incurred the resentment of Zeus for taking the part of mortals when Zeus intended to crush them and to send them to the abode of Hades, and also for giving them fire and teaching them all the arts. As a punishment, Zeus binds him to a rock in Scythia, and appoints a vulture to prey on his liver. This is the subject of the 'Prometheus Desmotes,' or 'Prometheus Bound,' of Æschylus.

Another old form of the legend, which closely resembles that which Æschylus followed, is given in the 'Theogony' of Hesiod. Hesiod says that when the gods and men were engaged in a controversy with one another at Mecone (an antient name of Sicyon), Prometheus, wishing to deceive Zeus, took an ox, and dividing it, placed the flesh and the viscera in the hide, and the bones of the ox in the inside fat, and then asked Zeus to make his choice. Zeus, though aware of the deception, chose the bones and the fat, 'designing evil in his mind against mortal man,' and in revenge withheld fire from man. Prometheus however secretly stole fire from heaven and gave it to man, and Zeus in return bound Prometheus with chains to a pillar, and sent an eagle to prey upon his liver. Zeus also, in order to injure man, created Pandora, and, after bestowing upon her numerous gifts, sent her to man a 'beautiful mischief, for from her is sprung the race of women, of whom the race is thoroughly destructive.' Hesiod, in his poem entitled 'Works and Days,' gives at greater length the legend of Pandora, and says that Zeus sent her to Epimetheus; and that he, not following the advice of Prometheus, who had told him never to receive a gift from Zeus, but to send it back again, took her into his house. These stories are supposed to have a meaning: Prometheus is the personification of *fore-thought*, and Epimetheus of *after-thought*.

There is another form of the legend respecting Prometheus, in which he is represented not merely as the friend and protector of the human race, but as their creator. This form is an old one, though neither Hesiod nor Æschylus has followed it. There is a fragment of Callimachus, in which he says, 'If Prometheus formed thee, and thou art not sprung from some other clay.' Plato has adopted this form of the legend in the 'Protagoras,' but with the variation that Prometheus is not the creator, but only the person who endowed man with his senses. He says that the gods formed all mortal animals within the earth, out of the mixture of earth and fire, and of as many things as are mingled with earth and fire, and that they entrusted to Prometheus and Epimetheus the business of providing them with all the faculties necessary for their preservation. He then proceeds to say that Epimetheus begged of Prometheus that he might have the business himself in the first place, and that Prometheus should overlook his work when he had done it. Epimetheus accordingly proceeds to his work, and bestows upon the different animals the means of preserving themselves; but when man came to be provided for, who was to be superior to all other animals, Epimetheus had been so prodigal of all his resources, that he had nothing left to bestow upon man. Prometheus, being at a loss how to remedy the omission of Epimetheus, steals from Hephæstus and Athena fire and the intelligence which is displayed in works of art, and gave them to man; so that by means of this wisdom, and fire as its instrument, men were endowed with the power of providing for themselves.

Some modern writers suppose that, in the earliest form of the legend, Prometheus was not considered as a deity, but simply as the representative of the human race, and that afterwards he was made a god, the friend and protector of man, and at last their creator.

PROMISSORY NOTES. [Bill of Exchange.]

PROMO'TUS, ÆLIUS (Αἴλιος Πρόμωτος), an Alexandrian physician, whose date is not exactly known. Villoison (*Anecd. Gr.*, tom. ii., p. 179, not. 1) says that he lived after the time of Pompey the Great, but Passevin (*Bibl. Select.*, p. 17), and Ant. Bongiovanni, in his letter to Giov. della Bona (Io. à Bona, *Tract. de Scorbuto*, Veronæ, 1781, 4to.), consider him to be much more antient. He is probably the person mentioned by Galen (*De Compos. Medicam. sec. Loca*, lib. iv., cap. 6); and he is the author of several Greek medical works, which are still in MS. in different European libraries. The prologue to one of these, entitled *δυναμερὸν*, i.e. *Congeries Medicaminum secundum Loca*, together with some extracts from it, is to be found in Bona's treatise quoted above, and is reprinted by Kühn, in his 'Additam. ad Elench. Medicor. Vet. à Io. A. Fabricio exhibit.,' 4to., Lips., 1826. The extracts consist of recipes for different diseases. The work exists in MS. in St. Mark's Library at Venice, No. ccxcv., 4to. (Morell, *Bibl. Inst.*, *cum Græc. tum Latin.*, i. 170.) Fabricius mentions another of his works, entitled *ἰατρικὰ, φυσικὰ, καὶ ἀντιπαθητικά*, which exists in MS. at Leyden among the books belonging to Voss. Schneider says (*Præfat. in Nicand. Alexipharm.*; p. 19) that, judging from an extract sent him by Ruhnken, the work is so full of absurdities as not to deserve to be published. Another of his works, entitled *περὶ ἰοβόλων καὶ δηλητηρίων φαρμάκων*, is to be found in the libraries at Rome and at Paris. Mercuriali has inserted a few fragments in his 'Variæ Lectiones' (lib. iii., cap. 4), and several times quotes it in his work 'De Venenis, et Morbis Venenosis,' lib. i., cap. 16; lib. ii., cap. 2), from which it appears (lib iii., cap. 4) that he agreed with Ælian (*De Nat. Anim.*, lib. vi., cap. 20), Apollodorus (ap. Plin., *Hist. Nat.*, lib. xi., cap. 30), and Nicander (*Ther.*, v. 769, &c.), in dividing scorpions into nine species. Kühn tells us (*loco cit.*) that Weigel also meditated an edition of the *δυναμερὸν*.

PRONOUNS, the name given by grammarians to certain words which are used as substitutes for the names of persons and things. Pronouns properly so called are commonly divided into personal, demonstrative, relative, and interrogative pronouns; but it appears probable that all pronouns, at least with the exception of the first and second personal pronouns, were originally demonstrative. William Humboldt remarks that the first and second personal pronouns 'are not mere substitutes for the names of the persons for whom they stand, but involve the personality of the speaker and of the person spoken to, and the relation between them;' and in writing and conversation there is frequently hardly any name which can so clearly designate the person intended as the appropriate personal pronoun. The third personal pronoun in English appears to have been originally a demonstrative, and to contain the same root, *ta*, *sa*, or *ha*, which occurs in the demonstrative pronoun in the Latin, Greek, and other cognate languages. The different forms of the demonstrative pronoun in these languages is explained under Article, and its declension, as well as that of the first and second personal pronouns, is given under Language, p. 310.

The relative pronoun may also be regarded as a demonstrative; for whether the pronoun is used to denote an object pointed out at the time by the speaker, or an object mentioned just before, or one which is to be immediately brought before the hearer's mind, it is equally demonstrative. In the last of these cases the pronoun is called a relative, as 'I saw the man *whom* you mentioned.' In English we have two forms for the relative, *that* and *who* or *which*. The former is the same word as the demonstrative; the latter contains the same root as we find in the Latin *qui*, the Sanscrit, Zend, and Lithuanian *ka*, and the Gothic *hver* and *kva*. The interrogative pronoun is the same as the relative in English and many of the cognate languages, and only differs from the relative in referring to something subsequent and unknown; whereas the latter refers to an antecedent and definite subject.

PRONUNCIATION. [ORATORY.]

PRONY, GASPARD CLAIR FRANÇOIS MARIE RICHE DE, was born at Chamelet, in the department of the Rhone, July 22, 1755. His father was a member of the parliament,' or chief civil court of the antient principality of Dombes; and at the College of Thoissey in that principality Prony received his education 'till 1776, when he entered the École des Ponts et Chaussées.' Here his assiduity was such as to lead Perronnet to foretell that he would one day occupy his own position, that of head of the establishment. He first became known as an author by an Essay on the 'Thrust of Arches,' published in 1783, about which time he began to be employed, under Perronnet, upon several public works, among which may be mentioned the restoration of the port of Dunkirk (1783), and the erection of the bridge of Louis XVI. (1787-90), of which last the engineering plan is said to have been drawn up and its execution superintended by Prony.

In 1790, he published the first volume of his 'Hydraulic Architecture.' The second appeared in 1796. Prior to this, the only work of the kind accessible to the engineer was the standard work bearing the same title, by Belidor, published in 1737-53, so that, as Delambre observes, the progress which the theory of mechanics had made in the hands of Euler, D'Alembert, Lagrange, and Laplace, had lain without real application to the arts of construction. Prony's work is perhaps the first of an elementary character in which the directions of forces, and the systems on which they act, are referred to rectangular co-ordinate axes. It contains a clear exposition of the steam-engine, at a time when the steam-engine was scarcely known on that side of the Channel; but his empirical formulæ for determining the elasticity of steam, the investigation of which occupies a considerable portion of the second volume, have been entirely superseded by more recent researches. His method of determining the diameter of a steam-cylinder Tredgold designates as 'little better than telling the artist to guess at it, and correct his guess by an intricate formula.' The same author remarks that the labours of Prony in this department 'afford the strongest evidence that mere mathematical talent is not sufficient for the promotion of mechanical science, otherwise the principle of the steam-engine would not have remained to be investigated.'—(Tredgold *On the Steam-Engine*, Lond., 1838, 4to., i., p. 33.)

Among other scientific projects of the French revolutionary government at this period, was that, suggested by Carnot and others, of computing a set of mathematical tables, by which it was supposed two objects would be attained:—the application of the decimal division of moneys, weights, and measures, then recently introduced, would be facilitated; and the world astonished by the 'most vast and imposing monument of calculation which had ever been executed or even conceived.' The direction of this laborious undertaking was confided to Prony in 1792 (year ii.), and with him were associated three or four of the principal mathematicians of Paris, including Legendre. It was however easy to foresee that their joint efforts, and the exclusive devotion of the rest of their lives, would alone be inadequate to the completion of the task they had undertaken. Occupied with this discouraging reflection, Prony opened by accident a volume of Adam Smith's 'Wealth of Nations,' at a part where the author is instancing the manufacture of needles, in illustration of the principle of the division of labour. 'Why,' thought Prony, 'should not the same principle be applicable, and with equal advantage, in the manufacture of logarithms?' Pondering on the practicability of this, he retired into the country, and in a few days returned with his plan of operations fully digested. He divided his assistants into three sections; the first, of which Legendre was the president, was occupied in selecting from 'amongst the various analytical expressions which could be found for the same function, that which was most readily adapted to simple numerical calculation, by many individuals employed at the same time.' (Babbage, *Economy of Manufactures*, p. 191.) These expressions included several very elegant formulæ investigated by Legendre, for determining directly the successive differences of the sines. The second section 'consisted of seven or eight persons of considerable acquaintance with mathematics; and their duty was to convert into numbers the formulæ put into their hands by the first section, an operation of great labour; and then to deliver out these formulæ to the members of the third section, and receive from them the finished calculations.....The third section, which consisted of from sixty to eighty members, received certain numbers from the second section, and using nothing more than simple addition and subtraction, they returned to that section the tables in a finished state.' (Babbage, pp. 191-2.) The whole of the calculations, which, to secure greater accuracy, were performed in duplicate, and the two MSS. subsequently collated with care, were completed in the short space of two years. They occupy seventeen 'enormous' folios, and consist of—1, An introduction, containing the analytical formulæ and the mode of using the tables; 2, 10,000 natural sines to 25 places of decimals, with seven and eight columns of differences; 3, The logarithms of 100,000 sines to 14 places of decimals and 5 columns of differences; 4, The logarithms of the ratios of the first 5000 sines to their corresponding arcs to 14 decimal places; 5, A similar table of the ratios of the tangents to their arcs; 6, The logarithms of 100,000 tangents; 7, The logarithms of numbers from 1 to 100,000 to 19 decimal places, and from 100 to 200,000 to 14 decimal places, with 5 columns of differences. In 1820 a distinguished member of the Board of Longitude, London, was instructed by our government to propose to the Board of Longitude of Paris, to print an abridgment of these tables at the joint expense of the two countries: 5000*l* was named as the sum which our government was willing to advance for this purpose, but the proposal was declined, and the great 'Tables du Cadastre' are still confined, in manuscript, to the library of the Paris Observatory.

Prony was appointed professor of mechanics to the Ecole Polytechnique in 1794, the year of its institution, and the same year he became directeur-général des Ponts et Chaussées. As professor to the Ecole Polytechnique he was indefatigable in endeavouring to bring the researches of modern mathematicians within the comprehension of his pupils. This was the object of his 'Mécanique Philosophique,' Par., 1800, 4to. It is an analytical synopsis of mechanics, hydrostatics, and hydraulics. The right-hand pages are each divided into four columns, headed notation, definition, theorems, problems; while those to the left are occupied with so much of investigation and reasoning as is just sufficient to connect the several results in the mind of the student.

In 1798 Napoleon invited him to become a member of the Institute of Egypt, which however he declined, and his refusal was never entirely forgotten or pardoned. Nevertheless, after Napoleon's coronation as king of Italy (1805), Prony was charged with the engineering operations for protecting the province of Ferrara from the further inundations of the Po; and about the same time, or earlier, he was employed in superintending the works then carried on by the French government in the ports of Genoa, Ancona, Pola, and in the Gulf of Spezzia, including some very intricate investigations connected with the tides, currents, and deposits of the Adriatic and canals within the Venetian territory. Napoleon's animosity towards Prony appears to have been counteracted only by a regard for his abilities. We are told by Arago that Prony's researches relative to the thrust of embankments ('poussée des terres'), and on the proper dimensions of lining-walls ('murs de revêtement') Paris, 1802, 4to., with the obvious practical utility of the results to which they led, were the means of securing Napoleon's suffrage. On a later occasion, when the emperor was distributing the new dignities which he had created, a secretary of state reminded him of Prony, to which he merely replied, 'Il ne faut pas mettre son rabot en dentelles; on ne pourrait plus s'en servir pour raboter.'

In 1810 he was appointed (in conjunction with Count Fossombrone of Florence) chief of the Commissione de l'Agro Romano, which had for its object the more effectual drainage and improvement of the Pontine Marshes. 'The results of his labours in this very important task, which he prosecuted with extraordinary zeal and success, were embodied in his "Description Historique et Hydrographique des

Marais Pontins," which appeared in 1823, and which contains a very detailed account of the past, present, and prospective condition of those pestilential regions, and a very elaborate and scientific description of the principles which should guide us in all similar cases in order to effect their permanent restoration to healthiness and fertility.' [Pomptine Marshes.] (*Edinburgh Journal of Science*, xv., p. 527.)

After the Restoration he continued to be employed in various important works, among which was the formation of extensive embankments near the mouth of the Rhone. In 1817 he became a member of the Bureau de Longitude: the following year he was elected one of the fifty foreign members of the Royal Society, London: in 1828 he was created a baron by Charles X.: and in 1835 a peer of France. He died at Aonières, near Paris, the latter end of July, 1839.

In his professional character Prony was the reverse of imperious. He gave his opinion on all occasions with exemplary frankness. Those who were associated with him in any of his undertakings continued ever after his friends, and there is no instance of a pupil claiming his support without its being cordially granted. That he was mindful of his obligations to others is shown by his calling on Arago in 1837, and desiring him not to omit in his 'Eloge of Carnot,' then about to be published for the first time, that the latter had saved his (Prony's) life in 1793. As a mathematician and philosopher, though inferior to some of the great men of his day, he was certainly one 'of whom his country may justly be proud, whether we consider the extent and character of his scientific attainments, or the variety of important, practical, and useful labours in which his life was spent.'

The following works, with those already mentioned, will, we believe, nearly complete the list of Prony's literary labours:—1, 'Experimental and Analytical Essay on the Laws of Expansion observed by Elastic Fluids, and on the Expansive Force of the Vapours of Water and Alcohol at different Temperatures,' Par., 1794, 4to. (also printed in the first volume of the 'Journal de l'Ecole Polytechnique'); 2, 'Plan of Instruction for the Students of the National School des Ponts et Chaussées, for the year vii.,' Par. 1795; 3, Analysis of the 'Exposition du Système du Monde' of Laplace, Par. 1801, 8vo.; 4, 'Plan of Instruction for the Polytechnic School so far as regards the Equilibrium of Bodies,' Par. 1801, 4to.; 5, 'Report made to the Mathematical and Physical Class of the National Institute, upon divers inventions of Jean Pierre Droz, relative to the Art of Coining,' Par. 1801, 4to.; 6, 'Report on the Memoir of Ducros relative to the supply of Water requisite for Canals,' Par. 1801, 8vo.; 7, 'Results of Experiments for determining the Relation between the French Mètre and the English Foot,' Paris, 1802; 8, 'On the supply of Water requisite for the Canal Saint Quentin' ('Sur le Jaugeage des Eaux Courantes qui doivent alimenter le bassin du passagé du Canal Saint Quentin'), Par. 1802, 4to.; 9, 'Physico-Mathematical Researches in the Theory of Flowing Waters,' Par. 1804, 4to.; 10, 'On the Computation of Latitudes and Longitudes,' Par. 1806, 4to.; 11, 'On the Variations in the Inclination of the Seine, and its Amount for each day of the years 1788-89-90, together with the Report made to the Academy of Sciences, January 29, 1791, by Lavoisier, Laplace, and Coulomb,' Par. 1806, 4to.; 12, 'Summary of Lessons on the Motion of Solids and on the Equilibrium and Motion of Fluids,' Par. 1809, 4to.; 13, 'Lessons in Analytical Mechanics delivered to the Royal Polytechnic School,' Par. 1815, 4to.; 14, 'On Bréguet's Metallic Thermometers,' Par. 1821, 4to.; 15, 'On the work of M. Sept-Fontaines relative to the Cubature of Timber,' 4to., no date; 16, 'On Swing-Bridges' ('Ponts à Bascules'), 4to., no date; 17, 'New System of Trigonometrical Levelling,' Par. 1822, 8vo.; 18, 'On the large Logarithmic and Trigonometrical Tables adapted to the new Decimal System of Weights and Measures,' Par. 1824, 4to.; 19, 'On the recently instituted Professorship of the Harp in the Royal School of Music,' Par. 1825, 4to., 12 pages; 20, 'Synopsis (Résumé) of the Theory and Formulæ relative to the Motion of Water in Tubes and Canals,' Par. 1825; 21, 'Report on the Old and New Steam-Engines erected at Paris, au Gros-Caillou,' Par. 1826, 8vo.; 22, 'Fragments of an unedited Memoir,' Lyon, 1827, 8vo. (16 pages); 23, 'Elementary Instructions on the Calculation of Musical Intervals by assuming either the Octave or the Twelfth Octave as the Unit of Comparison;' 'Analytical Formulæ for calculating the Acoustic Logarithm of any proposed Number, &c., with applications to Musical Instruments,' Par. 1832, 4to.; 24, 'Examination of the proposals for levying a Toll ('Projets de Barrage') on the Seine near Hâvre,' Par. 1831, 8vo. (also in the 'Annales des Ponts et Chaussées'); 25, 'On the Inflexions which, after the lapse of twenty years, had taken place in certain straight lines drawn upon the bridge Louis XVI., prior to the removal of the centering, with Formulæ and Tables for calculating the change which settlement ('le tassement') produces in a circular arch,' Par. 1832, 20 pages; 26, 'Formules pour calculer les Hauteurs des Remons occasionés, soit par des Rétrécissements, soit par des Barrages (avec écoulements de fond) pratiqués dans les Lits des Eaux Courantes,' Par. 1835, 8vo. (also in the 'Annales des P. et C.'); 27, 'On the Measurement of the Dynamical Effects of Rotatory Machines,' Par., 4to., no date; 28, 'On Regulating the Duration of the Oscillations of the Pendulum,' Par., 4to., no date.

To the *Recueils de l'Institut* he contributed—1, 'Notice of the Life and Works of Pingré,' tom. i, 1798; 2, 'On the Conversion of Circular Movement into Rectilinear,' ii., 1799. To the *Journal de l'Ecole Polytechnique*—1, 'On a Course of Elementary Analysis, by Lagrange,' tom. i., 1794; 2, 'Course of Mechanics for the Year V.,' ii., 1795; 3, 'Eloge de Lamblardie,' ib.; 4, 'On the Principle of Virtual Velocities and the Decomposition of Circular Motions,' ib.; 5, 'Introduction to Pure Analysis and of Analysis as applied to Mechanics,' ib.; 6, 'Theory of Rotation about a Free Axis,' ib.; 7, 'On the Particular Solutions of Differential Equations and their Application to Engineering,' iv., 1810; 8, 'On the Hydraulic System of Italy,' ib.; 9, 'Detailed Analysis of the Questions relative to the Motion of a Body acted upon by any Powers whatever,' ib.; 10, 'On the New Sluice of M. de Baucourt,' viii., 1809. See also the *Bulletin de la Societé Philomathique*; *Annales des Mines*; *Encyclopédie Méthodique* ('Forêts et Bois'); *Connaissance des Temps*, after 1800.

('Discours prononcé par M. Arago, le 3 Août, 1839, sur la tombe de M. de Prony,' given in the *Annuaire* for 1840; *Biographie des Contemporains*; *Edinburgh Journal of Science*, vol. xv.; 'Note sur la Publication proposée par le Gouvernment Anglais, des grands Tables Logarithmiques and Trigonometriques, de M. de Prony,' Paris, 1820, quoted by Babbage in his *Economy of Machinery and Manufactures*, London, 1832; *Parliamentary Papers*, 1823, xv., p. 9, &c.; Querard's *Dictionnaire Bibliographique*; *The Works of Prony*, &c.)

PROOF. [Demonstration; Evidence; Miracle; Oath; Probability.]

PROPE'RTIUS, SE'XTUS AURE'LIUS, a native of Hispellum, or, according to others, of Mevania in Umbria. The year of his birth is not stated by any antient authority, but he himself (iv. 1, 127, &c.) says that he took the toga libera (which was generally taken at the age of fifteen) at the festival of the Liberalia, soon after the battle of Philippi, which was fought in 42 B.C., so that he must have been born about the year 56 B.C. His family was of equestrian rank (iv. 1, comp. with Plin., *Epist.*, vi. 15, and ix. 22), and when, after the campaign of Philippi, Augustus rewarded his veterans with assignments of lands, the family of Propertius was, like many others who had supported the cause of Antony, deprived of their estates. About this time or soon afterwards, young Propertius went to Rome, where he devoted himself entirely to poetry (iv. 1, 134). In Rome he soon attracted the attention and gained the friendship of contemporary poets, such as Ovid, who always speaks of him with fondness (*Trist.*, ii. 465; iv. 10, 53; v. 1, 17; *Ars Amat.*, iii. 334; and in other places). He also enjoyed the patronage of Mæcenas, and lived on the Esquiline, perhaps in the gardens of his patron himself. His property seems to have been very small, for no estate or villa of his is mentioned. Mæcenas tried to induce him to write an epic poem, in which he was to celebrate the achievements of Augustus (ii. 1), but Propertius refused to comply with the wish of his patron, at least partly; and seems purposely to have described himself as a man given to sensual enjoyments, in order that no such lofty claims might be made upon him. The fourth book of his 'Elegies' however contains a series of poems on Roman legends, especially those of a religious nature. Now, as Augustus restored many old religious forms, it does not seem improbable that the poet here at least partially intended to fulfil the wish of Mæcenas. It has been supposed that Propertius died at a very early age, but Nobbe (*Observationes in Propertii Carmina*, 1817) has shown that the first book of his 'Elegies' was not written before the year 33 B.C.; the second not before 24 B.C.; the third not before 21 B.C.; and the fourth not before 16 B.C.; and according to these dates he must at least have lived until the year 16 B.C., to the age of forty. An accurate Life of Propertius is still a desideratum in the history of Roman literature. His connections of friendship, to which allusions are made in his poems, as well as those of his contemporaries, might furnish some materials towards it.

Propertius, in his poetry, took Callimachus and Philetas as his models, and his ambition was to be considered the Roman Callimachus, to which a sneering allusion is made by Horace (*Epist.*, ii. 2, 100). We possess four books of Elegies of Propertius; whether he wrote more is uncertain. In the first three books he sings of his beloved Cynthia, whose real name is said to have been Hostia; the fourth, which by some editors has been subdivided into two, is chiefly occupied with heroic and religious legends, in which the poet seems to have possessed considerable learning; and he delights in showing it, though he thereby weakens the effect of his poetry. The Elegies addressed to Cynthia, who herself was a woman of eminent talents, form a kind of romance, and, considering the character of the age, evince an almost unparalleled faithfulness and constancy between the lovers. But Propertius has nothing of the effeminate sentimentality of Tibullus, and, notwithstanding his passionate love, he always retains his manly character, and shows great energy and independence of mind. The agreeable effect which this kind of poetry might produce is impaired by the artificial character of his style, in which he followed the Greek poets of the Alexandrian period. The antients however looked upon him as a great poet. (Plin., *Epist.*, ix. 22; Quintil., x. 1.)

Propertius used formerly to be edited together with Catullus and Tibullus, as in the editio princeps, Rome, 1472, and in that of Scaliger, Paris, 1577, reprinted in 1582 and 1600. A separate edition of Propertius appeared in 1702, 4to., at Amsterdam, with a commentary by Broukhusius. The most complete edition is that of P. Burmann, which was published after his death, in 1780, by Santen. For the establishment of a correct text much has been done in the editions of Lachmann (Leipzig, 1816), Paldamus (Halle, 1827), and Jacob (Leipzig, 1827).

Propertius was translated into French prose, in 1655, by De Marolles; and in 1821 appeared the second edition of a translation into French verse, by Mollevant. Among the numerous German translations it is sufficient to mention that of J. H. Voss (Braunschweig, 1830), and another by Gruppe (Leipzig, 1838), with critical notes on the Roman Elegy. Some of the Elegies of Propertius were translated into English in the 'Miscellaneous Poems by Oxford Hands,' London, 1685; in 1782 was published, in London, 'The Book of the Elegies of Propertius, entitled Cynthia, translated into English verse, with classical notes,' &c.

PROPERTY is derived, probably through the French language, from the Latin word Proprietas, which is used by Gaius (ii. 89) as equivalent to ownership (dominium), and is opposed to possessio. [POSSESSION.] The etymology of the word proprietas (proprius) suggests the notion of a thing being a man's own, which general notion is contained in every definition of property. Blackstone (ii. 1) defines 'the right of property' to be 'that sole and despotic dominion which one man claims and exercises over the external things of the world, in total exclusion of the right of any other individual in the universe.' A foreign writer defines ownership or property to be 'the right to deal with a corporeal thing according to a man's pleasure, and to the exclusion of all other persons.'

This definition excludes incorporeal things, which however are considered objects of property in our law, and were also considered as objects of property in the Roman law, under the general name of jura or iura in re; they were considered as detached parts of ownership, and so opposed to dominium, a word which represented the totality of the rights of ownership. (Savigny, *Das Recht des Besitzes*, 5th ed., p. 166.) This definition also describes property as consisting in a right, by which word right is meant 'a *legal* power to operate on a thing, by which it is essentially distinguished from the mere possession of the thing, or the physical power to operate upon it. Consequently such a right is not established by the possession of the thing; and it is not lost, when the possession of the thing is lost. Such a right can also be enforced by him who possesses the right by an actio in rem against every person who possesses the thing, or disputes his right to it.' (Mackeldey, *Lehrbuch des heutigen Röm. Rechts*, ii., p. 1-36.) This definition, which is characterised by a precision and accuracy which are altogether wanting in that of Blackstone, is here adopted. By property then is here understood only that which the positive law of a country recognises as property, and for the protection or recovery of which it gives a remedy by legal forms against every person who invades the property, or has the possession of it.

Austin observes ('An Outline of a Course of Lectures on General Jurisprudence') that 'dominion, property, or ownership is a name liable to objection. For, first, it may import that the right in question is a right of unmeasured duration, as well as indicate the indefinite extent of the purposes to which the entitled person may turn the subject. Secondly, it often signifies property, with the meaning wherein property is distinguished from the right of possession. [POSSESSION.] Thirdly, dominion, as taken with one of its significations, is exactly co-extensive with *jus in rem*, and applies to every right that is not *jus in personam*.' The first sense of the word property is expounded by determining, as hereafter explained, the quantity and quality of an estate as understood in English law. As to the second, possession is of itself no right, but a bare fact, and its relation to rights in rem is the same as the physical to the legal power to operate on a thing. The doctrine of possession is therefore distinct from and should precede the doctrine of property. [POSSESSION.] The third sense of property has reference to the legal modes of obtaining the possession of a thing in which a man can prove that he has property and a present right to possess.

A complete view of property, as recognised by any given system of law, would embrace the following heads, which it would be necessary to exhaust, in order that the view should be complete. It would embrace an enumeration of all the kinds or classes of things which are objects of property: the exposition of the greatest amount of power over such things as are objects of property, which a man can legally exercise—and connected with this, the different parts or portions into which the totality of the right of property may be divided, or conceived to be divided: the modes in which property is legally transferred from one person to another, that is, acquired and lost: the capacity of particular classes of persons to acquire and transfer property as above understood; or, to take the other view of this division, an enumeration of persons who labour under legal incapacities as to the acquisition and loss of property.

The following general outline of property is adapted to the English system of Law. It may be filled up by references to other articles in this work, or to treatises.

1. The kinds or classes of things which are objects of property.

The general division is into Things Real and Things Personal, the incidents to which are so different in the system of English Law that they must be separately considered.

Things Real are comprehended under the terms of Lands, Tenements, and Hereditaments. The word Hereditaments is the most comprehensive of these terms, because it comprehends every thing which may be an object of inheritance, both Things Real, and also some Personal Things, such as heirlooms, which are objects of inheritance.

Hereditaments are divided into Things Corporeal and Incorporeal. A Corporeal Hereditaments is land, in the legal sense of the term. An Incorporeal Hereditament is defined by Blackstone to be 'a right issuing out of a thing corporate (corporeal), whether real or personal, or concerning or annexed to, or exerciseable within the same.' Perhaps the definition is not quite exact, and it would not be easy to make an exact definition. The Things Incorporeal of the English law correspond in their general character to the Res Incorporales of the Roman Law, one distinguishing character of which is that they are incapable of tradition or delivery (Gaius, ii. 28): the Res Corporales of the Roman Law are things which are capable of tradition, whether moveable, as a horse, or immoveable, as a house. The Incorporeal hereditaments enumerated by Blackstone are, Advowsons, Tithes, Commons, Ways, Offices, Dignities, Franchises, Corodies or Pensions, Annuities, and Rents.

2. The greatest amount of power over such things as are objects of property which a man can legally exercise.

To this head belongs the English doctrine of Tenure, or the various ways in which land is said to be *held*. Though this was a much more important part of English law than it now is, it is still of importance; for Tenure always exists wherever there is the relation of landlord and tenant. As all land in the kingdom is held mediately or immediately of the crown, it follows that a man cannot have a Property in land which shall not be subject to this right of the crown. He cannot operate upon his Property in land in any way so as to destroy this right; and consequently the utmost amount of Property in land which a man can have, is limited. The interest which a man can have in any land, tenement, or hereditament, is called an Estate; and this word comprises the greatest amount of power and enjoyment, both as to time and manner, which a man can legally have over and in any of the three things just enumerated, as well as the smallest legal amount of such power and enjoyment: it also comprises, under the notion of time, the determination of the period when his power and enjoyment shall commence, as well as when they shall cease. Lands, tenements, and hereditaments then being objects of Property, a man may either have the most complete property in such things which is legally allowed, or he may have the least property in them which the law allows; and both this complete and this limited Property is expressed by the word Estate. An estate in a thing is Property in a thing, and Property in a thing is legally considered to be capable of division into defineable parts, called Estates, each of which estates has its defineable legal incidents. With reference to an estate the time during which the right of enjoyment continues is usually expressed by the term Quantity of Estate. The manner in which the enjoyment is to be exercised during this time is often expressed by the term Quality of Estate: thus a man may enjoy an estate solely or in joint-tenancy; his enjoyment may be co-extensive with the largest amount of legal enjoyment of any estate, or it may be limited by the contemporaneous Rights of others in or to the Property in which he has an Estate, that is, he may have the legal enjoyment for a determinate time, subject to various limitations and abridgments of the fullest enjoyment of Property. The time when the enjoyment of the Estate shall commence is also considered a part of its Quality; and the time of enjoyment commencing is either present, that is, contemporaneous with the acquisition of the estate, or future. It may not be useless to remark that here and elsewhere, where the word Estate is used in its technical sense, it does not mean the thing enjoyed, but the quantity and quality of enjoyment of the thing.

Independent of the quality and quantity of an estate, there is another modification of property which requires notice. A person may have the estate both as to quantity and quality in the sense above explained, either with or without the right to the beneficial enjoyment. The person who has merely the Estate in quantity and quality, has the bare legal Estate. He who has not the right to the Estate in quantity and quality, as above explained, but merely to the enjoyment of such estate, while the other has not, is said to have the equitable estate. The term quality of estate might be used to express this equitable interest; but inasmuch as we want a word to express the manner and mode of enjoying an estate as distinct from the time of enjoyment, and as quality is the word used to express that manner and mode, it must not be used in a different sense. The explanation of the nature of an equitable as distinguished from a legal estate belongs to Uses and Trusts.

It has been said that this distinction between legal and beneficial or equitable property is peculiar to the English law. (Lord Mansfield, 1 *T. R.*, 759, n.) But these two kinds of property existed in the Roman law, and the theory of the division of ownership or property into Quiritarian or legal, and bonitarian, beneficial, or equitable, was fully developed. Its origin in the Roman law is not certain; but it is a probable conjecture that its origin so far resembled the origin of the like division in English law, that it was due to the attempt to get rid of the difficulties attending the alienation of property by the old legal forms. 'There is,' says Gaius (ii. 40), 'among other nations (peregrini) only one kind of ownership or property (dominium), so that a man is either owner or not; and it was the same in the old Roman law, for a man was either owner 'ex jure quiritium,' or he was not. But ownership was afterwards divided, so that one man may now be owner of a thing ex jure quiritium, and another may have the same thing in bonis. For if in the case of a res mancipi, I do not transfer it to you by mancipatio, or in jure cessio, but only deliver it, the thing indeed will become yours beneficially (in bonis), but it will remain mine legally (ex jure quiritium), till you have acquired the property by usucapion; for as soon as the time of usucapion is completed, from that time it begins to be yours in full ownership (pleno jure), that is, the thing begins to be yours both in bonis and in jure, just as if it had been transferred by mancipatio or in jure cessio.' This passage seems to suggest a conjecture as to the origin of the distinction between legal and equitable property which was of so much importance in Roman law. The distinction between the two kinds of ownership or property was as clearly marked as in our system, though it was not applied to all the purposes to which this divided or double ownership is applied in our system.

3. The modes in which property is legally transferred from one person to another.

Property may either be acquired in a single thing, or in several things of the same kind at one time: or it may be acquired in a great variety of different kinds of things at the same time, which pass to the new owner, not as individual things, but as the component parts of a whole property. The Roman law designated the former mode of acquisition by the term acquisitio rerum singularum; and the latter by the term acquisitio per universitatem. Though the two modes of acquisition exist in our law, there are no names for them by which they are placed in opposition to one another. The case of acquisitio per universitatem, or of universal succession, occurs when a man is made a bankrupt or insolvent, and an assignee or assignees are appointed. [Bankrupt, p. 396; Insolvent, p. 496]; in which cases the whole of a man's property real and personal, as well as his rights and obligations generally, become the legal property of the assignee or assignees, and is applicable and must be applied according to the rules of law in the cases of bankruptcy and insolvency. With respect to personal property, universal succession occurs when a man by his last will appoints an executor; and an administrator with the will annexed, or without the will annexed when there is none, thereby acquires the whole personal property of the intestate. Both the heir and devisee also, in a sense, take by universal succession.

As to both singular and universal succession, the modes of acquisition of estates in things real are reducible to two general heads—descent and purchase. 'Descent or hereditary succession is the title whereby a man on the death of his ancestor acquires his estate by right of representation as his heir at law' (Blackstone); and an estate so acquired is commonly called an estate of inheritance.

Purchase, which is corrupted from the Latin word perquisitio, is defined by Littleton (i. 12) to be 'the possession of lands or tenements that a man hath by his deed or agreement, unto which possession he cometh not by title of descent from any of his ancestors, or of his cousins (consanguinei), but by his own deed.' Purchase as thus defined comprehends all the modes of acquiring property by deed or agreement, and not by descent; but it is not a complete description of purchase, as now understood, for it omits the mode of acquisition by will or testament, which however, when Littleton wrote, was of comparatively small importance, as the power of devising lands did not then exist, except by the custom of particular places. Blackstone makes the following enumeration of the modes of purchase—Escheat, Occupancy, Forfeiture, and Alienation. As to escheat, there is some difficulty in the classification, as the title appears to be partly by descent and partly by purchase.

The head of alienation comprehends every form by which a man transfers property to another: it comprehends therefore both alienations made by a person during his life, and the disposition of his property by his last will and testament. The disposition of property by will has this peculiarity about it, that though the instrument must be completed in legal form during the lifetime of the giver, the persons to whom the property is given do not thereby obtain the property; they only obtain it by the death of the giver, who by that event becomes incapable of giving, but whose continuing intention to give is testified by the continuing existence of the instrument of gift.

The particular modes of alienation by deed are to a certain extent determined by the estate which the alienor possesses, and the estate or estates which he intends to transfer. The forms of alienation are noticed under their various heads.

4. The legal capacity for the acquisition of estates in

lands, tenements, and hereditaments, is most briefly and conveniently shown by the enumeration of the classes of persons who labour under legal incapacity; and in like manner, as to the alienation or loss of estates, it is most conveniently shown by enumerating the persons who, owing to mental incapacity, infancy, or other causes, labour under legal incapacity to transfer or lose estates. This division comprehends so much of the status of aliens, infants, lunatics, and married women, as relates to the acquisition or loss of estates.

Personal Property is not sufficiently described by the term 'moveables,' for certain estates in land are personal property, and are comprehended under the term Chattels Real. Terms for years are an example of chattels real; and they pass together with the rest of a man's personal estate to the executor, the universal successor. Chattels Personal are all other personal property, and are said by Blackstone 'to be properly and strictly speaking things *moveable*, which may be annexed to or attendant on the person of the owner, and carried about with him from one part of the world to another. Such are animals, household stuff, money, jewels, coin, garments, and everything else that can properly be put in motion, and transferred from place to place.' Personal property as thus defined corresponds to the mobilia or res mobiles of the Roman law; but this is a very inadequate description of personal property as recognised by the English law. And herein we first perceive the greater certainty and distinctness of the law relating to real property compared with the law relating to chattels; the things which can be the objects of real property are definable, as well as the estates that can be had in them; the things that can be the objects of personal property are hardly determinable, and the estates, or more properly the interests, which a man may have in them, are perhaps also less determinate. As examples of objects of personal property, which in no way come within Blackstone's description, we may instance patent-rights, which are things incorporeal, though not hereditaments, and are the objects of property.

A quantity of stock in the public funds is not money, though often talked of as such, but still it is property. Even debts due to a testator or intestate are considered as property with respect to probate and letters of administration; still they are not expressed by the term goods and chattels in the letters of administration, but by the term 'credits,' for as debts are not the property of a man to whom they are due, so they cannot became property because he happens to die. Things can be assigned by the person who has a claim to them, though they may be things which cannot be called his property: a chose in action is an instance of this. Blackstone observes: 'the money due on a bond is a chose in action; for a property in the debt vests at the time of forfeiture mentioned in the obligation, but there is no possession till recovered by course of law.' He had just before spoken of the nature of property in action being such that a man 'hath not the occupation, but merely a bare right to occupy the thing in question.' From this it appears that he treats a debt due to a man as a property belonging to him, whereas the debt due merely gives a right of action to recover a determinate sum of money, or a sum which is less than some determinate sum. In this instance, says Blackstone, 'the property or right of action depends upon an express contract or obligation to pay a stated sum.' Here he uses property and right of action as synonymous, which is incorrect; for property implies a determinate thing, and a right of action may be either for a determinate thing or to compel a person to do some determinate act. The thing claimed is properly enough called a 'thing in action,' but the action is not to have a thing, but that the defendant shall do a certain act. Blackstone observes, in a note, that the same idea and the same denomination of property prevailed in the civil law, but this is a mistake. In the first passage (*Dig.* 41, tit. 1, s. 52), to which he refers in support of his statement, it is clear that a corporeal definite thing is spoken of, which the commentator could hardly have doubted about, if he had given in his note the whole of the passage instead of a part of it. The passage is this: 'a thing is a man's *in bonis*, whenever he can defend his possession of it by a plea (exceptio), or recover it when lost by an actio.' This actio would be in rem; the declaration of the plaintiff would affirm that the thing was his. In the other passage quoted by Blackstone (*Dig.* 50, tit. 16, s. 49), things which consist 'in actionibus, petitionibus, persecutionibus' are included among the things *in bonis*; but the things in action so spoken of are things which a man has not, as contrasted with things which a man has, in his possession, and these are things corporeal, things determinate. Besides, even if we should admit that the Roman law treated a debt as a thing *in bonis*, it did not treat it as property, for a thing in bonis was not property in the sense in which Blackstone is here using property. Further, when a Roman claimed a debt, his declaration was that something ought to be given to him or done for his benefit by the defendant; and this 'giving' always meant giving something which did *not* belong to the plaintiff, for it was a principle of Roman law that you could not give to a man what already belonged to him. But the Roman law had a precision in these matters of which the commentator had not the slightest idea.

From these remarks it will appear, first, that there is a difficulty in classifying the things that are objects of personal property; second, that things, as choses in action, are not property, and yet they can be transferred (in equity) as if they were property. Accordingly it happens that it is sometimes difficult to say whether a particular thing is an assignable thing or not, whether in its nature it is capable of any transfer.

Property in Chattels may, like property in Things Real, vary as to quantity and quality of interest, though things personal are not capable of such extended and various modifications, analogous to estates, as things real are. As to quantity, that is, duration, a man may have the use of a personal thing for life, and another may have the absolute property in it after his death. As to quality, persons may own a thing personal as joint tenants and as tenants in common. There is an equitable property in chattels as well as in things real. Money, for instance, is often paid to a trustee, in order that he may give the interest of it to one person for life, and after his death pay the money to another. The trustee, so long as he holds the money, has the legal property in the money, and in the thing in which the money is invested. A legatee has only an equitable interest, even in a specific legacy, after his testator's will is proved, until the executor gives the thing to him, or in some clear way admits his right to it.

The modes of acquiring and losing personal property are reduced by Blackstone to the following principal modes Occupancy; Prerogative, whereby a right accrues to the crown or the crown's grantee; Forfeiture, which is a punishment for a crime or misdemeanour; Custom, as heriots, &c.: Succession, by which term Blackstone understands the capacity of a corporation aggregate to take what their predecessors had; Marriage, by which the husband acquires the chattels of the wife, and the right of suing for her choses in action, and a peculiar kind of interest in her chattels real; Judgment; Gift or Grant; Contract; Bankruptcy, so far as relates to chattels; Testament; Administration. The enumeration taken from Blackstone is not here offered as one that is complete or altogether unexceptionable. Under Contract Blackstone includes sale, as to which it may be observed that the formalities required by the law for the transfer of ownership in things personal are few; but the difficult questions which arise as to the transfer of property in personal things are probably much more numerous than in the case of estates in things real.

Under Contract he also comprehends bailment, by which 'a special qualified property is transferred from the bailor to the bailee together with the possession.' This qualified property, as it is called, gives the bailee a right of action against all persons who injure or take away the chattels; and Blackstone, as usual, finds a reason for this right of action. This right of action is however really founded on the right of possession, and it is just the same right of action that a man has who finds a thing, against any person, except the owner, who injures or takes away the thing. This right, when understood, is in all respects consistent with sound principles; and there is no objection to calling it a right founded on a qualified property, when the term qualified property is rightly understood. Under contract, he also includes hiring and borrowing, and these also are contracts which, he says, may transfer a qualified property to the hirer or borrower. The same remarks apply to this kind of property as to that acquired by bailment. There is however a case in which a man must acquire an absolute property by borrowing, as in the case of the Roman Mutuum, when the thing borrowed is a thing which consists 'pondere, numero, or mensurâ,' as, for instance, so many pounds of butter. The distinctions of the Roman Law between Hiring, 'Locatio et Conductio,' Lending, 'Mutuum,' 'Commodatum,' and 'Depositum,' are founded on unchangeable principles, and are expounded in that system with a clearness which, in this respect, ours perhaps does not admit.

The incapacities of persons as to acquiring Personal Property are fewer than those as to Real Property; and the incapacities to transfer and lose are also fewer. But a complete enumeration of the classes of persons who labour under either of these incapacities, and the particular incapacities of each of such classes, would probably be more difficult than a like enumeration as to Estates in Real Property.

PROPHECY (*προφητεία*, a foretelling, or the power of foretelling), in its popular acceptation is a foretelling, or a thing foretold. It may however be more correctly defined a speaking by inspiration, whether the things spoken relate to the present, the past, or the future; but it must be observed that this definition assumes inspiration as an historical fact.

In the Septuagint, *propheteia* (*προφητεία*) answers to *nevuah* (נְבוּאָה), from *nava* (נָבָא), which, according to Gesenius is to 'bubble forth,' and so, to utter words copiously, as persons do who speak under a divine afflatus, or a strong excitement. In classical Greek, *prophêtes* (*προφήτης*) corresponds with the Latin *vates*, which indeed may be regarded as the same word without the preposition. Thus St. Paul uses *prophetes* (*Tit.*, i. 12), which is rendered 'prophet' in the authorised version, but 'poet' by Tyndale; and probably Epimenides is meant. S. Chrysostom (*Hom. in* 1 *Cor.*) says that *prophetes* is the same as *herméneutes* (*ἑρμηνευτής*), an interpreter; and Festus says that the chief priests of the temples and interpreters of the oracles were by the antients called prophets. In *Exod.* vii. 1, God says to Moses, 'I have made thee a God to Pharaoh, and Aaron thy brother shall be thy prophet,' *i.e.* interpreter; or, as it is expressed (iv. 16) 'He shall be to thee instead of a mouth.' Abraham is called a prophet (*Gen.*, xx. 7), *i.e.* an intercessor between God and man. In the New Testament, prophesying is several times used in the sense of interpreting the hard places of the Old Testament, as Themistius calls a man who interpreted the obscurities of Aristotle, 'the prophet of Aristotle.' 'The sons of the prophets' appear to have been pupils in the schools of the prophets, and to have been trained for the office of instructing the Jewish people orally upon the principles laid down in the Mosaic law. Some of the Jewish prophets were particularly distinguished as writers, and their instructions mingled with predictions (called by the general title of prophecies) were added to the other sacred books, and became of canonical authority. These prophets thus carried on, enlarged, and spiritualised the code which had originally been given by Moses; and they probably handed down through each generation certain doctrines made known to the patriarchs, which the law was not designed to unfold.

Under ORACLE it is observed that there were current in antient Greece numerous so-called prophecies, such as those of Bacis and Musæus, mentioned by Herodotus (viii. 20, 77, 96; ix. 43). Dr. Barrow is of opinion that, 'though many of these prophecies were dark and ambiguous, or captious and fallacious, yet some were very clear and express, according as God was in his wisdom pleased to use the ministry of those spirits, which immediately conveyed them in directing men for their good, or misguiding them for their deserved punishment, such as were for instance that concerning Cyrus his conquering the Lydians; that concerning the battle at Salamis; that concerning the battle of Leuctra; and divers others which occur in stories composed by wise men of the wisest nations.' (*Sermon* ix. *on the Creed.*) When however such prophecies come to be rigidly examined, they will be found of the kind of productions concerning which Lord Bacon says, 'That that hath given them grace, and some credit, consisteth in three things. First, that men mark when they hit, and never mark when they miss..... The second is, that probable conjectures, or obscure traditions, many times turn themselves into prophecies, while the nature of man, which coveteth divination, thinks it no peril to foretell that which indeed they do but collect..... The third and last (which is the great one) is, that almost all of them, being infinite in number, have been impostures, and by idle and crafty brains merely contrived and feigned after the event past.' (Bacon's *Essays.*) But this was not the case with the prophecies recorded in the Bible. Some of these were extant in books written long before the events took place to which they refer, such as the prophecy concerning Abraham's posterity, their extraordinary increase, their sufferings in Egypt four hundred years, their sojourning in the wilderness, and their possessing at length the land of Canaan; the prophecy concerning Josiah (1 *Kings*, xiii. 2), who was expressly named 361 years before the occurrence of the event in which he was the chief agent (2 *Kings*, xxiii. 15, 16); the prophecy concerning Cyrus, who is also mentioned by name (*Isaiah*, xliv., xlv.); his conquests, his restoring the Jews from exile, and his rebuilding of Jerusalem; the prophecy of Jeremiah concerning the Captivity, and its duration 70 years; the prophecy of Daniel (viii.) concerning the profanation of the Temple by Antiochus Epiphanes, with a description of this man's temper, countenance, &c., 408 years before the accomplishment of the event. These prophecies relate to the Jewish people in particular; but there are others relating to Tyre, and Egypt, and Nineveh, and Babylon, which, in a manner no less striking, present, in all their circumstances of delivery and fulfilment, a perfect contrast to the supposed predictions of the ancient pagans. The numerous prophecies in the Old Testament pertaining to the Messiah, with their accomplishment recorded in the New Testament, and the prophecies of Jesus and his Apostles, are so familiar to the minds of all, that they need not be specified. The prophecies of the Old and New Testament, which have been long fulfilled, afford altogether an amount of evidence which, if really understood, it seems impossible to resist, in proof of the Bible being a revelation from God. Upon the question when prophecy ceased to be given among the Jews, and when among the Christians, and upon the subject of unfulfilled prophecy, we must abstain from entering.

The prophecies of the Old and New Testament are understood by all believers in scriptural prophecy to be predictions of future events pronounced by persons who, on the occasion of delivering such predictions, were directed and governed by the Deity. The first thing to establish in the examination of these prophecies is the genuineness of the books in which they are contained. The question is, whether the prophecies in the form in which we have them, were delivered before the events to which it is alleged that they refer. This is purely a matter of historical criticism, and in no respect differs in the manner of carrying on the investigation, from an inquiry of a like kind as to any other book. The next inquiry is to compare the alleged prophecy with the events of which it is alleged that it was a prediction. This, though apparently the easier part of the inquiry, is one wherein much difference of opinion may exist. Some of the prophecies are clear and precise in their terms; and when the former part of the inquiry has had a satisfactory result, no unprejudiced person can doubt that the prophecies do refer to certain definite events. Some of the prophecies are in their terms vague and general; and others refer to events which, it is admitted, have not yet been accomplished. So far as it is admitted that any prophecy has not been accomplished, so far it must be admitted that prophecy fails in being substantiated by the only evidence that can establish its truth. It is then on those events which all believers allege to be events accomplished, in conformity to genuine predictions, that the proof of prophecy depends. The method of investigation is that which has been already mentioned, and every man should come to it with an unprejudiced mind.

On prophecy in general the reader may be referred to John Smith's *Select Discourses*, 4to., Cambr., 1673, and 8vo., London, 1821; Sherlock's *Use and Intent of Prophecy*, 8vo, London, 1725; Bishop Newton's *Dissertations on the Prophecies*, often printed; with other well-known works treating directly or indirectly on the subject.

PROPITHE'CUS, Mr. Bennett's name for a genus of quadrupeds allied to the *Lemurs*, and thus characterised by him:—

Muzzle moderate. Hinder extremities longer than the anterior ones. Index abbreviated. Tail long, hairy.

Dental Formula:—Incisors $\frac{4}{4}$; canines $\frac{1}{1}\ \frac{1}{1}$; molars —;

(upper) two first cuspidate, the third elongated, externally bituberculated, the fourth like the preceding; (lower) first unicuspidate, second and third plurituberculate.

Example, *Propithecus Diadema*.

Description.—Face nearly naked, with short blackish hairs about the lips, and equally short yellowish-white hairs in front of the eyes. Above the eyes, the long, silky, waved, and thickly-set hairs which cover the body commence by a band of yellowish white crossing the front and passing beneath the ears to the throat. This is succeeded by black, extending over the back of the head and neck, but becoming freely intermingled with white on the shoulders and sides, the white gradually increasing backwards so as to render the loins only slightly grizzled with black. At the root of the tail fulvous, that colour gradually disappearing until the extreme half of the tail is white with a tinge of yellow. Outer side of the anterior limbs, at the upper part, of the slaty grey of the sides, below which it is pale fulvous. Hands black except tufts of long fulvous hairs at the extremities of the thumb and fingers, extending beyond and covering the nails. Outer sides of the hinder limbs, after receiving a tinge of fulvous from the colour surrounding the root of the tail, of a paler fulvous than the anterior limbs; this becomes much deeper on the hands, which are fulvous except on the fingers, where there is a very considerable intermixture of black, the terminal tufts, equally long with those of the anterior hands, being, as in them, fulvous. The under surface white throughout, except the hinder part of the throat, where it is of the same colour with the sides of the body.

Hairs generally long, silky, waved, erect, and glossy; shorter and more dense on the crupper, where they offer a sort of woolly resistance. General character of those on the tail, that of the body hair, but shorter.

Thumb of anterior hands slender, placed far back, and extremely free; length 1¼ inch, extremity of its penultimate phalanx ranging slightly beyond the end of the metacarpal bone of the index. Index 1½ inch in length, its extremity ranging with the middle of the penultimate phalanx of the second finger. Length of second finger 3 inches; that of third finger 3¼ inches. Length of carpus and metacarpus 2 inches.

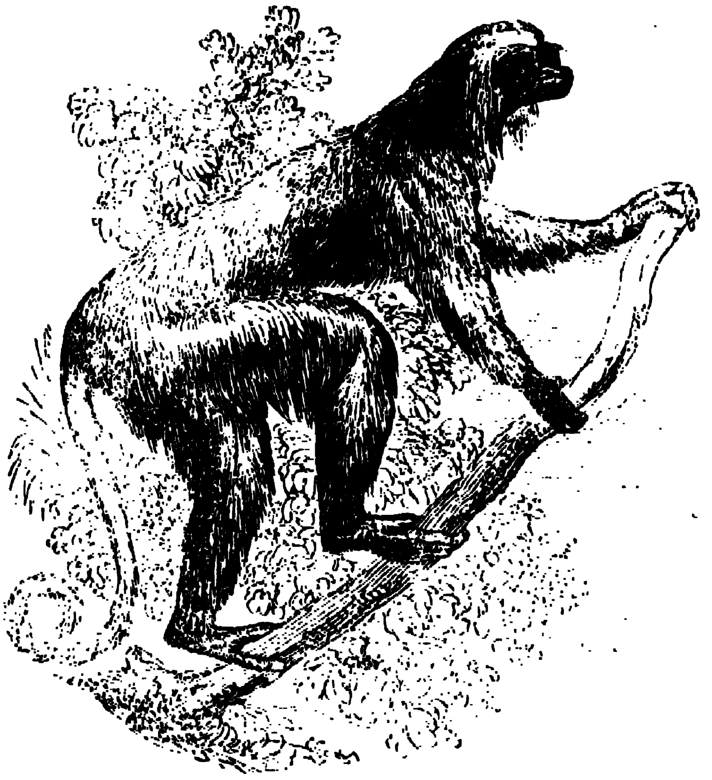
Thumb of hinder hands very strong, placed forwards and ranging with the fingers, 2 inches long; index 2½ inches, the pointed nail extending half an inch beyond: length of second finger, 3¼ inches; of tarsus and metatarsus, 3 inches.

Length of body and head, measured in a straight line, 1 foot 9 inches; of the tail, 1 foot 5 inches. Anterior limbs, exclusive of hands, 7¼ inches in length from the body; posterior limbs, 15¼ inches.

Muzzle shorter than in the *Lemurs* generally; the distance from the anterior angle of the orbit to the tip of the nose (1¼ inch) being equal to that between the eyes. Ears rounded, concealed in the fur: length 1 inch; breadth 1½ inch.

Affinities, &c.—Mr. Bennett remarks that *Propithecus* is essentially distinguished from *Lemur*, the genus to which it most nearly approaches, by the number and form of its teeth, and especially by the form of the incisors of the upper jaw, which constitute apparently a regular series, a structure unknown in any other Lemuridous animal. This difference, striking as it is, is however, he observes, more of an apparent than a real deviation from the type of the family, inasmuch as a tendency to dilate laterally towards their cutting edges is to be found in the upper incisors of a *Lemur*, and it is only the extreme development of this dilatation that gives to the teeth of *Propithecus* a peculiarity of character rather resembling at first sight that of the *Monkeys* than the *Lemurs*. The number of the incisors of the lower jaw, he adds, differs from that of *Lemur*, but occurs in another genus, *Indri* [LICHANOTUS], and he remarks that in *Propithecus*, as in *Indri*, the canine teeth of the lower jaw close behind those of the upper, a conformation which tends to invalidate the opinion of M. Geoffroy St. Hilaire, that the outer of the six incisors of the lower jaw ought rather to be regarded as canine teeth, the usual position of the lower canines when the mouth is closed being anterior to the upper. The number of false molars, continues Mr. Bennett, in *Propithecus*, is one less in each jaw than in *Lemur*, and they are less smooth and not so acutely triangular; the second in the upper jaw being in fact somewhat tuberculate on its outer edge, and forming, as it were, a transition from the false to the true molars, between which it is placed. The posterior molars were not examined. Mr. Bennett concluded by observing that the external characters by which *Propithecus* is distinguished from *Lemur* are its shorter muzzle, terminated by more approximate nostrils, the upper margin of which appears to be only slightly lobulated; its rounded ears; the marked disproportion in length between its hinder and anterior extremities; the greater length of its hands, especially of the anterior; the shortness of its anterior thumb, which is also placed much farther back; the marked abbreviation of the anterior index; the development and power of the hinder thumb, which is nearly an equal opponent to the whole of the fingers; and the comparative shortness of the hairs by which the tail is covered.

Locality.—Madagascar, whence the specimen was sent and presented to the Zoological Society by C. Telfair, Esq., Corr. Memb. Z. S. Habits unknown. (*Zool. Proc.*, 1832.)



Propithecus Diadema.

PROPONTIS. [MARMARA, SEA OF.]

PROPORTION. There must be in the mind of every person, antecedently to all mathematical instruction, a perfect conception of proportion, though not perhaps of the manner of measuring magnitudes with a view to express their proportions by means of numbers. All who can trace the resemblance of a drawing to the original, or have the least notion of the use of a map, are in possession of the fundamental notions on which a theory of proportion can be founded. The term RATIO is that under which the first part of the subject should be treated, and the article cited will contain matter preliminary to the present one. It will be sufficient for our present purpose to state that the ratio or relative magnitude of two magnitudes is to be measured by the number of times or parts of times which one is contained in the other, whenever the two are commensurable; and we shall now confine ourselves to the purely mathematical treatment of the theory of proportion, and avoid, as much as the nature of the subject will admit, all discussion of the notion of ratio considered as a magnitude.

We cannot well explain the nature of the difficulty which occurs in the theory of proportion, without a prior reference firstly to the purely arithmetical treatment of the subject, and, secondly, to the *practical* sufficiency of this method which is the necessary consequence of our physical constitution.

If all magnitudes of the same kind were necessarily commensurable, that is, if any one among them being taken as a unit, the rest were all expressible by multiples, aliquot parts or submultiples, and multiples of aliquot parts, of the unit chosen, no difficulty would arise in making the subject of proportion purely arithmetical. For let a and b represent the units, parts of units, or both, in two magnitudes of the same kind (as two lines); any sufficient demonstration of the rule for the division of one fraction by another will show that a contains b precisely a number of times and parts of times. If then we say that a is to b in the same proportion as c to d, we mean that a contains b precisely such times and parts of times as c contains d; that is, we assert the equation

$$\frac{a}{b} = \frac{c}{d};$$

the mathematical treatment of which is so easy, that no one who can solve a simple equation can be stopped for a moment by the difficulty of any consequence of it. The following proposition, which may be proved generally, contains all the consequences which are most useful. Let a, b, c, and d be (in the arithmetical sense) proportional: take any two functions of a and b, which are homogeneous and of the same dimension (such as $ab + b^2$ and $a^2 - b^2$). Take corresponding functions of c and d (which are $cd + d^2$ and $c^2 - d^2$); then the four numbers so obtained are also proportional (that is, $ab + b^2$ contains $a^2 - b^2$ as many times and parts of times as $cd + d^2$ contains $c^2 - d^2$).

In measuring magnitudes of which the numerical representatives are afterwards to be submitted to calculation, it necessarily follows, from the imperfections of our senses, that some imperceptible amount of magnitude must always be neglected or added; so that, for example, that which we call a line of 3 inches long means something between 2·9 and 3·1, or 2·99 and 3·01, or 2·999 and 3·001, according to the degree of accuracy of the measurement. All magnitudes therefore are practically commensurable; for suppose, in the case of weights for example, that a grain is taken as the unit, and that the ten-thousandth part of a unit is considered as of no consequence; then by taking every weight only to the nearest ten-thousandth of a grain, they may every one be expressed arithmetically with a conventional degree of precision, which for every purpose of application will do as well as though it were perfectly accurate.

The discovery of INCOMMENSURABLE magnitudes, one of the most striking triumphs of reason over the imperfection of the senses, was made at a very early period; since the demonstration of their existence, the classification (to a certain extent) of their species [IRRATIONAL QUANTITIES], and the means of overcoming the difficulties which they present, appear in the writings of Euclid. A moment's consideration will show that a property of numbers, a relation of figure in geometry, a general law of nature, may be inferred from induction with a degree of probability which will amount to moral certainty, both as to the exactness and universality of the property, relation, or law. But the existence of incommensurable magnitudes can never be made certain, except by absolute deduction: no attempt at measurement, a *minimum visibile* existing, could show the non existence of any common measure, however small. Suppose for instance that, having provided means of measurement which can always be depended on to show the *thousandth* of an inch, but nothing less, a person should accurately (as the word is commonly used) lay down squares of one, two, &c. inches in the side, with a view to render the existence of a common measure to the side and diagonal exceedingly improbable by experiment. If not before, he would be baffled by the square whose side is 2378 inches, the diagonal of which could not by his measures be distinguished from 3363 inches, from which it differs only by about the *five-thousandth* part of an inch. And let any greater degree of exactness be attained in the means of measurement, short of positive accuracy, a reasoner on the subject could still predict a square which should defeat the object sought to be attained.

The mere existence of incommensurables, to say nothing of their frequent occurrence, and the impossibility of avoiding them, renders the arithmetical theory of proportion inexact in its very definition. If we would say, for instance, that the diagonal of a larger square is to its side as the diagonal of a smaller square is to its side, we enunciate a proposition the meaning of which is unsettled. For if we mean to assert that the larger diagonal contains the larger side as many times or fractions of times as the smaller diagonal contains the smaller, it is answered, by those who wish for precise notions, that neither diagonal contains its side any exact number of times or parts of times. If we should say that the larger diagonal lies between 1·414213 and 1·414214 times the larger side, and that the smaller diagonal also lies between 1·414213 and 1·414214 times the smaller side, and if we should show this to be true, we certainly show that we could produce lines very nearly equal to the diagonals, which are, under the arithmetical definition, proportional to the sides; and that this might be done without altering either diagonal by so much as the millionth part of the side. And the ten-millionth, hundred-millionth, or any aliquot part of the side, howeve[illegible]all, might be substituted for the millionth, without detriment to our power of showing the truth of the proposition. If we use the means by which this process may be carried on *ad infinitum*, we may perhaps be said to have established the truth of the proposition that the diagonals of squares are as their sides. But if we in any manner stop short of this, we destroy the rigorous character of geometry, and produce a system of mathematics which, like a common table of logarithms, is true to a certain number of places of decimals, and not farther. It is obvious that such a system of mathematics, like the table with which we have compared it, is sufficient for the purposes of practical application; nor have we the least quarrel with those who, desiring an instrument only, take one which is sharp enough for their purpose. We only complain of them when they assert and teach others that their tool has an edge keen enough to separate the minutest truth from the minutest falsehood; whereas, on examining it with a powerful microscope, we find the so-called sharp edge capable of being magnified into a plane of any dimensions, though it may appear a sharp edge to the unassisted senses.

The imperfection of the arithmetical definition of proportion is universally admitted, while the complexity of the rigorous definition by which Euclid supplied its place is almost as universally felt to be a grievance. Many attempts have been made to avoid the trouble without incurring the reproach of inaccuracy. One or two of these we shall notice.

Legendre, in his otherwise excellent work on geometry, refers the student to works on arithmetic for the theory of proportion; and, having stated that when A is to B as C to D, it is known that $A \times D = B \times C$, adds (twelfth edition, page 61), 'This is certainly true for numbers; it is true also for any magnitudes, provided they can be expressed, or that we imagine them expressed by numbers, and this we may always suppose.' A system of geometry which tells the learner in so many words that he may always suppose that which is not true, needs no further comment, even though Legendre were its author. It is true that in subsequent parts of the work we find demonstrations adapted to the case of incommensurable quantities, but they want that most important element of a proposition involving proportions, namely, a definition of what the term means; these demonstrations turn upon the theorem that when four quantities are proportional, the first is greater than, equal to, or less than the second, according as the third is greater than, equal to, or less than the fourth; but it has not been previously stated what the author means by four quantities being proportional. In the English translation of the preceding work, a preliminary chapter is added on proportion, in which the definition given as to incommensurable magnitudes amounts to the following:—when A and B are incommensurable, and also C and D, the four are said to be proportional when A' and C' can be found, as near as we please to A and C, and which, being commensurable with C and D, are proportional to them, in the arithmetical sense of the term. This is a sufficient definition; but it really amounts to that of Euclid (as do all sufficient definitions which we have seen), and is not so easily used.

M. Lacroix (*Elémens de Géométrie*, p. 5) makes the approximate finding of a common measure stand in place of an exact process, and, fairly stating that the error of the process may be made too small to be visible, rests the exactness of his geometry on its not being sensibly erroneous.

The author of the 'Elements of Geometry,' in the 'Library of Useful Knowledge,' states the proportion of incommensurable magnitudes to consist in 'their ratios admitting of being approximately represented by the same numbers, *to how great an extent soever* the degree of approximation may be carried.' In virtue of the words in italics, this definition may be considered as being, when properly used, capable of forming the basis of an exact theory; and that it is properly used in the work cited we fully admit, since its first application is to the establishment of the definition of Euclid. The only objection we should make to the work in question is that its expressions (page 48) would lead the student to imply that commensurability is the general rule, and incommensurability the exception; an extended theory is given, because magnitudes are not always commensurable. Now it is important the student should know, and should always bear in mind, that of two magnitudes of the same kind taken at hazard, or one being given and the other deduced by a geometrical construction, it is very much more likely that the two should be incommensurable than that they should be commensurable. So that the apparently cumbrous theory of proportion is not introduced to meet a few cases which sometimes occur, but to prevent the majority of instances from being treated incorrectly.

The definition of proportional quantities given by Euclid is as follows:—'Magnitudes are said to have the same ratio to one another, the first to the second, and the third to the fourth, when equimultiples of the first and third, and equimultiples of the second and fourth, whatever the multiplications may be, yield a multiple of the first, greater than, equal to, or less than, that of the second, according as the multiple of the third is greater than, equal to, or less than, that of the fourth.' That is, if A, B, C, and D be the four magnitudes, and *m* and *n* any two whole numbers whatsoever, *m* A must be greater than, equal to, or less than *n* B, according as *m* C is greater than, equal to, or less than *n*D. Otherwise thus, whatever whole numbers *m* and *n* may be, A must exceed, equal, or fall short of *n*-*m*ths of B, according as C exceeds, equals, or falls short of *n*-*m*ths of D. A person practised in algebra would comprehend the definition most easily when stated thus: $m\mathrm{A}-n\mathrm{B}$ must have the same sign as $m\mathrm{C}-n\mathrm{D}$, for all whole values of *m* and *n*.

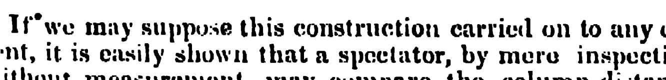
This definition equally applies whether A and B be commensurable or incommensurable, since no attempt is made to measure B by an aliquot part of A. The two questions which must be asked, and satisfactorily answered, previously to its reception, are as follows:—

1. What right had Euclid, or any one else, to expect that the preceding most prolix and unwieldy statement should be received by the beginner as the definition of a relation the perception of which is one of the most common acts of his mind, since it is performed on every occasion where similarity or dissimilarity of figure is looked for or presents itself?

2. If the preceding question should be clearly answered, how can the definition of proportion ever be used; or how is it possible to compare every one of the infinite number of multiples of A with every one of the multiples of B?

To the first question we reply, that not only is the test proposed by Euclid tolerably simple, when more closely examined, but that it is, or might be made to appear, an easy and natural consequence of those fundamental perceptions with which it may at first seem difficult to compare it. To elucidate this, suppose the following case:—

There is a straight colonnade composed of columns at equal distances from each other, the first being distant from a bounding wall by a length equal to the distance between any two successive columns. In front of the colonnade let there be a row of railings* equidistant from each other, the first being at the same distance from the wall at which the railings are from each other. Let the columns be numbered from the wall, and also the railings; remember also that it is not supposed that there goes any exact number of railings to the interval of two columns, but that the interval of the columns may be to the interval of the railings in any ratio, commensurable or incommensurable.



If we may suppose this construction carried on to any extent, it is easily shown that a spectator, by mere inspection without measurement, may compare the column-distance (C) with the railing-distance (R), to any degree of accuracy. For example, since the tenth railing falls between the fourth and fifth columns, it follows that 10 R is greater than 4 C and less than 5 C, or that R lies between $\frac{4}{10}$ of C and $\frac{5}{10}$ of C. To get a more accurate notion he may examine the ten-thousandth railing: if it fall between the 4674th and 4675th columns, it follows that 10,000 R lies between 1674 C and 4675 C, or R lies between $\frac{4674}{10000}$ and $\frac{4675}{10000}$ of C. There is no limit to the degree of accuracy thus obtainable; and it can also be shown that the ratio of C and R is determined when the order of distribution of the railings among the columns is assigned ad infinitum: or, which is the same thing, when the position of *any* given railing can be found, as to the numbers of the columns between which it lies. Any alteration, however small, in the place of the first railing, must at last affect the order of distribution. Suppose for instance, that the first railing is moved farther from the wall by one part in a thousand of the distance between the columns, the second railing must then be pushed forward twice as much, the third three times as much, and so on: those after the thousandth are pushed forward more than a thousand times as much, that is, by more than the interval between the columns; or the order with respect to the columns is disarranged.

Let it now be proposed to make a model of the preceding construction, in which *c* shall be the distance between the columns, and *r* that between the railings. It needs no definition of proportion, nor anything more than the conception which we have of that term prior to definition (and with which we must show the agreement of any definition we may adopt) to assure us that C must be to R in the same proportion as *c* to *r*, if the model be truly formed. Nor is it drawing too largely on that conception of proportion if we assert that the distribution of the railings among the columns in the model must be everywhere the same as in the original: for example, that the model would be *out of proportion* if its 56th railing fell between the 18th and 19th columns, while the 56th railing of the original fell between the 17th and 18th columns. Here then the question as to the dependence of Euclid's definition upon common notions is settled; for the obvious relation between the construction and its model which has just been described contains the collection of conditions, the fulfilment of which, according to Euclid, constitutes proportion. According to Euclid, whenever *m* C exceeds, equals, or falls short of *n* R, then *m c* must exceed, equal, or fall short of *n r*: by the most obvious property of the preceding constructions, according as the *m*th column comes after, opposite to, or before the *n*th railing, in the original, the *m*th column must come after, opposite to, or before the *n*th railing, in the correct model.

That the test proposed by Euclid is necessary, appears from the preceding; and also that it is sufficient. For, admitting that, to a given original, with a given column-distance in the model, there is one correct model railing-distance (which must therefore be the one which distributes the railings among the columns as in the original), we have seen that any other railing-distance, however slightly different, would at last give a different distribution: that is, the correct distance, and the correct distance only, satisfies all the conditions required by Euclid's definition.

Let us now, by the *distribution* of one set of magnitudes among those of another set, agree to mean the placing of the first magnitudes among those of the second set, the latter having been previously arranged in ascending order of magnitude. Thus, in the following instance, we distribute the multiples of 3 among those of 8, the latter being in Roman numerals:—

3 6 viii 9 12 15 xvi 18 21 xxiv 27 30 xxxii &c.
24

This use of the word distribution having been well learnt, the following way of stating the definition will be easier* than that of Euclid. 'Four magnitudes, A and B of one kind, and C and D of the same or another kind, are proportional when all the multiples of A can be distributed among the multiples of B in the same intervals as the corresponding multiples of C among those of D.' Or, whatever numbers *m* and *n* may be, if *m* A lies between *n* B and $(n+1)$ B, *m* C lies between *n* D and $(n+1)$ D.

If the preceding test be always satisfied from and after any given multiples of A and C, it must be true before those multiples. For instance, let the test be always satisfied from and after 100 A and 100 C; and let 5 A and 5 C be instances for examination, falling before 100 A and 100 C. Take some multiple of 5 which will exceed 100, say 50 times, and let it be found on examination that 250 A lies between 678 B and 679 B; then 250 C lies between 678 D and 679 D. Divide these by 50, and it follows that 5 A lies between $13\frac{28}{50}$ B and $13\frac{29}{50}$ B, and still more between 13 B and 14 B. Similarly 5 C lies between $13\frac{28}{50}$ D and $13\frac{29}{50}$ D, and still more between 13 D and 14 D. Or 5 A lies in the same interval among the multiples of B in which 5 C lies among the multiples of D: and the same demonstration applies to any other instance.

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* By the terms column and railing we mean throughout to designate vertical lines which are the axes of the columns or railings.

* The Greek of Euclid's definition is very short, and can only be intelligibly rendered into English by circumlocution. Ἐν τῷ αὐτῷ λόγῳ μεγέθη λέγεται εἶναι, πρῶτον πρὸς δεύτερον καὶ τρίτον πρὸς τέταρτον, ὅταν τὰ τοῦ πρώτου καὶ τρίτου ἰσάκις πολλαπλάσια τῶν τοῦ δευτέρου καὶ τετάρτου ἰσάκις πολλαπλασίων, καθ' ὁποιονοῦν πολλαπλασιασμὸν, ἑκάτερον ἢ ἅμα ἐλλείπῃ, ἢ ἅμα ἴσα ᾖ, ἢ ἅμα ὑπερέχῃ ληφθέντα κατάλληλα.

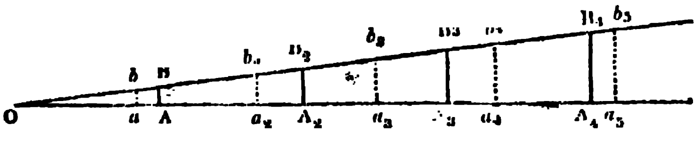
Again, the test is also satisfied if the multiples of any multiple (m) of A are distributed among the multiples of any multiple (n) of B in the same manner as the multiples of mC among the multiples of nD: for instance, if the multiples of 3 A be distributed among those of 5 B in the same manner as the multiples of 3 C among those of 5 D. Let 11 A and 11 C be given for examination: take any multiple of 3 greater than 5, say 3 × 3, or 9, and examine 11 (9 A) and 11 (9 C) or 33 (3 A) and 33 (3 C). Let 33 (3 A) lie between 27 (5 B) and 28 (5 B); then by hypothesis 33 (3 C) lies between 27 (5 D) and 28 (5 D). Divide all by 9, and we find that 11 A lies between 15 B and $15\frac{5}{9}$ B, while 11 C lies between 15 D and $15\frac{5}{9}$ D. Hence 11 A lies between 15 B and 16 B, while 11 C lies in the same interval among the multiples of D: and in the same manner any other instance may be proved.

The principles of the fifth book of Euclid are by many supposed to be inevitably connected with the apparatus of straight lines drawn parallel to one another, by which Euclid represents his magnitudes and their multiples. This is not the case; and the simple algebraical expression of magnitudes by large letters, and of numerical multipliers by small ones, will very much facilitate the demonstrations, without altering anything but mere modes of expression.

The next point to be considered is the infinite character of the definition of proportion; four magnitudes are not to be called proportional, until it is shown that every multiple of A falls in the same intervals among the multiples of B, in which the same multiple of C is found among the multiples of D. So that this definition is a negative one, like that of parallel lines, which may be thus stated: two lines are parallel when every point of one of them, however far produced, is on one side of the other. We might expect then to find that the test of *disproportion* is simple and positive, and an examination of the illustration already produced will confirm this.

Suppose that the distribution of the railings among the columns should be found to agree in the model and the original as far as the millionth railing. This proves, as we have seen, only that the railing distance of the model does not err by the millionth part of the corresponding column distance; for if it did err so much, the multiplication of the error a million-fold would have placed the millionth railing (if none before it) wrong by at least one interval. It is then obvious that no examination of individual cases, however extensive, will enable an observer of the construction and its model to affirm the proportion or deny disproportion: all that it can do is to enable him to fix limits (which he may make as small as he pleases) to the disproportion, if any. But a single instance may enable him to deny proportion or affirm disproportion and also to state which way the disproportion lies. Let the 19th railing in the original fall beyond the eleventh column, while the 19th railing of the (so called) model does not come up to the eleventh column. It follows from this one instance, that the railing-distance of the model is too small relatively to the column-distance, or that the column-distance is too great relatively to the railing distance. That is, the proportion of r to c is less than that of R to C, or the proportion of c to r is greater than that of C to R. Similarly, with respect to two straight lines, no examination of pairs of points, one in each, will enable the examiner to affirm their parallelism or deny their intersection: while, at the same time, the examination of one pair of points may enable him to affirm intersection or deny parallelism. Hence it appears that, obvious as the notion of proportion may be, it is more easy, in a mathematical point of view, to define disproportion, and to make proportion consist in the absence of all disproportion. Similarly, obvious as is the notion of parallelism, and the connection of the non intersection of two straight lines with that of their always keeping the same distance with each other, it is more easy to define this relation by the absence of all intersection than by any of its positive properties.

The negative character of the definition of parallels does not prevent it from being very easily proved that such lines exist; and an examination of the first or last propositions of the sixth book of Euclid will show that the existence of proportional quantities is as easily established on the definition given as on any other. To take an instance however in which nothing but lines shall be the objects of consideration, we shall here prove, in a different manner, the second proposition of Euclid's sixth book, or one to the same effect.



Let OAB be a triangle, to one side of which ab is drawn parallel, and in OA produced set off AA_2, A_2A_3, &c. equal to OA, and aa_2, a_2a_3, &c. equal to Oa. Through every one of the points so obtained draw parallels to AB, meeting OB produced in b, b_2, B_2, &c. Then it is easily proved that bb_2, b_2b_3, &c. are severally equal to Ob, and BB_2, B_2B_3, &c. to OB. Consequently a distribution of the multiples of OA among those of Oa is made on one line, and of OB among those of Ob on the other. The examination of this distribution in all its extent (which is impossible, and hence the apparent difficulty of using the definition) is rendered unnecessary by the known property of parallel lines. For since A_3 lies between a_3 and a_4, B_3 must lie between b_3 and b_4; for if not, the line A_3B_3 would cut either a_3b_3 or a_4b_4. Hence without inquiring where A_m *does* fall, we know that if it fall between a_n and a_{n+1}, B_m must fall between b_n and b_{n+1}: or if $m \times \mathrm{OA}$ fall in magnitude between $n \times \mathrm{O}a$ and $(n+1) \times \mathrm{O}a$, then $m \times \mathrm{OB}$ must fall between $n \times \mathrm{O}b$ and $(n+1) \times \mathrm{O}b$. Thus it is established that OA is to Oa as OB to Ob.

The propositions of the fifth book become very simple when the definition is fully elucidated, and algebraical expression is substituted for the words at length of Euclid. They will be found thus treated in Playfair's or Lardner's editions of Euclid, and in the 'Connection of Number and Magnitude' (London, 1836).

When quantities are commensurable, a multiple of one may be found which is exactly equal to a multiple of the other: thus if $A = 3\frac{4}{13}B$, $13A = 43B$. In this case the arithmetical definition of proportion is sufficient, and the other may be shown to follow from it. Let $A = 3\frac{4}{13}B$, and $C = 3\frac{4}{13}D$, so that, arithmetically speaking, A is to B as C to D. Let mA lie between nB and $(n+1)$B, or $(3\frac{4}{13}m) \times B$ lies between nB and $(n+1)$B. Then the number or fraction $3\frac{4}{13}m$ must lie between n and $n+1$; whence $(3\frac{4}{13}m)$D lies between nD and $(n+1)$D, or mC lies between nD and $(n+1)$D.

It is however perfectly allowable to leave out of sight the possible case in which a multiple of A is exactly equal to a multiple of B; since if the test be true in all other cases, it is therefore true in this. For, if possible, let $4A = 7B$, and 4C be (say) greater than 7D. Then $m(4C)$ exceeds $m(7D)$ by m times this difference, which may be made as great as we please, or $4m$C, and multiples succeeding it, may be made to fall in an interval as many intervals removed from that of $7m$D and $(7m+1)$D as we please. But $4m$A is equal to $7m$B, whence $(4m+1)$A, &c. must fall among the multiples of B in intervals of given nearness* to the interval of $7m$B and $(7m+1)$B. Consequently the multiples of A following $4m$A cannot always fall among the multiples of B in the same intervals as the same multiples of C among those of D; and the rest of the test cannot be true, unless $4C = 7D$; that is, if the rest of the test be true, then $4C = 7D$.

The following question will enable the reader to see for himself how far he is able to apply the method of Euclid. Returning to the illustration, suppose that the columns, instead of being mathematical lines, are of a given thickness, and that the columns in the model are of a proportionate thickness; let it also be supposed that when a railing is projected upon the column, there are no means of determining on which side of the axis of the column it falls. It is to be shown that if the distribution be according to the definition as to every railing which is not so projected, and about which there is therefore no doubt, it must also be true as to every case in which the doubt exists.

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* We leave the reader to put this demonstration into a more exact form

The advantages of the study of proportion in the manner laid down by Euclid, or some other equivalent in extent and strictness, are precisely the advantages of accuracy over inaccuracy, and of real demonstration over a false and slovenly appearance of it, which, though a close resemblance, is therefore all the more dangerous. And it must be remembered what we mean by demonstration, namely, the process of obtaining a conclusion by sound logic from premises known to be true. If the prolixity of Euclid's method could be avoided by an assumption, we should not object, provided the assumption were both true and easily seen to be true. For instance, if the theory of Parallels could be established without its axiom by means of a hundred long and intricate propositions, we should agree with those who would refuse to place those propositions before beginners, on the ground that unimpeachable demonstration is already given, namely, an assumption which those who would rather dispense with it do not deny to be both true and easy (or capable of being made easy), and logic which is uncontested and incontestible. But the vice of the system which is substituted for that of Euclid consists in the entrance of an assumption which is *not* true; for to reason upon all magnitudes as if they were commensurable, and to assert conclusions derived from such reasonings, is to assume that all magnitudes are commensurable, which is not true. The method of Lacroix, as above explained, is sound as far as it goes: he asserts that the propositions of geometry are sensibly true, or if false, imperceptibly false, and this he proves. But he makes geometry cease to be an exact science. That of Legendre, on the other hand, though it proves no more than that of Lacroix, professes to prove more: it treats geometry as an exact science, while it avowedly states that an assumption may be made which is demonstrably incorrect.

We do not deny that a mind well versed in the doctrine of limits would have a process of its own, by which it would rigorise the method of Lacroix, arguing as follows: The same means which show the propositions of geometry to have no error perceptible to our senses, would also show them to have no error perceptible to any imperfect senses, however near to perfection they might be; and that error which is less than any assignable error, must be no error at all. All this, when properly extended, we might admit; but how are we to suppose, in the student who has just left the fourth book of Euclid, a perception of the truths of the doctrine of limits, the notorious want of which creates the difficulties of the differential calculus? Sound teaching makes a true theory of proportion one, out of many previous helps, to the attainment of the differential calculus: but the inversion of the process not only adds difficulty to the latter, by intercepting proper illustration, but introduces falsehood into the former; and such teaching is the most vicious of all vicious circles, because it propagates its kind.

The mathematical writers of this country have, taken all together, shown a superiority in exactness of demonstration over those of any other of modern times, and the deep and early root which the sound principles of Euclid have taken has been mainly the cause of this. If those principles be abandoned, that superiority will cease to exist; but this of itself would be of little consequence; not so the loss of a large amount of formation of accurate habits, which would certainly follow the substitution of a gross and (so called) practical instrument of calculation for an exact and liberal science.

Those to whom the mathematical sciences are taught as aids to the power of distinguishing truth from falsehood, logic from fallacy, the exact consequence from all incorrect inference, very many times exceed in number those who only wish for an instrument to be used in the study of physics and the arts of life. If then practical mathematics mean those mathematics which best answer the purpose of the great majority of learners, the more they are rigorous the more they are practical. But the enticing word *practical* has been otherwise appropriated; and 'exact enough for practical purposes' is the phrase applied to many a result of which the practical use belongs to the astronomer, mechanician, surveyor, engineer, or computer. To such a meaning of the word practical there is no objection as opposed to liberal or disciplinatory, when it is *knowledge* or *science* which is spoken of; but as applied to *art*, practical is opposed to unpractical, which cannot be carried into practice, or useless, for that which cannot be practised is useless in art. But those who would consider the use of knowledge in steadying the mind and making it a judge between the true and the false, and a safe guide to the methods of finding truth, must beware, in mathematics, how they allow the notions which art attaches to the word practical any influence over their method of studying science. For want of such a caution many have missed all comprehension of the higher branches even of the art to which they aspired, to say nothing of the loss of that science to which it should seem they did not mean to aspire.

PROPORTION. Much of the beauty of architecture depends upon proportion, or, in other words, that well-balanced regulation of the different parts of a structure which affects the eye and mind agreeably, all the members seeming agreeably adjusted to the whole, and the lesser details similarly adjusted to the separate features or larger members to which they belong. Accordingly great stress has been laid upon proportion by architectural writers, yet what they have said respecting it amounts to little more than artistical jargon; for not only do they generally restrict the term to proportion as regards individual parts, without reference to anything further, ascribing to them a positive charm, but some of them deny such merit altogether to any other styles than those of antient Greece and Rome and modern Italy. By proportion, in its technical sense, of course beauty of proportion is meant: yet it is surely a fundamental error to suppose, as some would have us do, that because what constitutes such beauty and such congruity of all the parts in the classical orders is not to be traced in the Gothic and other styles of the art, these latter can possess no corresponding beauty of their own. It would be about as rational to affirm that a horse has no proportions, or is an ill-proportioned misshapen animal, because its limbs are differently moulded and proportioned from those of a man.

What is it, if not the beautiful adjustment of parts to parts, that captivates us more or less in the productions of Gothic architecture? or wherefore do some buildings in that style charm us so much more than others, equally or even more meritorious perhaps in other respects, if not either by the harmony of their proportions, or the effect produced by some particular one, such for instance as loftiness, &c.? Indeed so very far from being devoid of proportions, Gothic architecture admits of infinitely greater variety in this respect than the columnar ordinances of the antients and moderns do; consequently, instead of being at all deficient in the elements and principles constituting proportion, it contains them in much greater abundance. It is indeed not the poverty but the copiousness of the Gothic, as regards diversity of proportions, that renders it almost impossible to systematise it, and to reduce it, as we have done the 'orders' (for we cannot say the Grecian and Roman *styles*), to a few positive rules which may be learned mechanically. So far it is beyond all comparison more difficult: and yet in one respect it seems conveniently easy, because conveniently accommodating, inasmuch as it affords very great latitude, and has no particular rules the infringement of which strikes at once as a solecism. Nevertheless this apparent facility is attended with some of the greatest difficulties, as is, unfortunately, too frequently made evident in our modern Gothic structures, which, even where the separate features or component parts are well proportioned in themselves, are rarely well put together, and agreeably proportioned upon the whole; or else, *vice versâ*, if the general proportions are good, those of the parts are not.

In respect to the Grecian orders [Civil Architecture] and those derived from them, architecture has certainly not been benefited by the system-makers, who would establish certain fixed proportions for each, and thereby reduce each order to a single pattern for a column and its entablature. Neither is it easy to comprehend why such very great merit, or indeed any merit at all, should be ascribed to doing that which may be done altogether by rule, and without the slightest exercise of any mental faculty. Yet, though they insist upon the strictest regard to certain proportions, as far as the order, or the columns and entablature alone, of a building are concerned, they make amends for such rigour by liberally tolerating the utmost laxity as to proportion in all other respects. Provided the order be of legitimate proportions in itself, it may be quite out of proportion to the whole of the structure, and every other part may be out of proportion to the columns: either large windows may be introduced between diminutive columns, and consequently placed at considerable intervals from each other; or else two or even more tiers of diminutive windows may be placed between huge columns running through several stories, without offending the criticism that would be absolutely shocked at meeting with columns half a diameter more or less in height than the fixed standard, no matter what reason there might be for deviating from it, nor how judiciously soever it might be done.

Were the orders and their proportions so absolutely and unconditionally beautiful in themselves, as has been contended, many modern buildings ought to produce a very different effect from what they actually do. We find too that buildings of the same order are totally different in their proportions and in the relation which their other parts bear to the columns and entablatures. The only kind of proportions in regard to which positive directions can be laid down, and which are therefore prepared for all alike without other study than that included in the usual course of elementary instructions, are those which relate to columns, doors, windows, niches, &c. For all these, certain relations between height and breadth have been established, originating in convenience and fitness, and not in any abstract notions of geometrical harmony or beauty. Were the latter the case, the square and equilateral triangle would recommend themselves as the most perfect forms, the one for windows, the other for pediments. This is so far from being the case, that no kind of square apertures are admissible, or capable of being rendered agreeable even where dictated by convenience, except for mezzanine windows, for if a window requires to be made of wide proportions, so as to approach a square, it must be divided into separate upright compartments or apertures, after the manner of what is called a Venetian window; otherwise, even although its dimensions should not be such as to render a single aperture inconvenient, it would produce a disagreeable effect, and look like a mere glazed gap, or as a Gothic window of wide proportions would do without its mullions. With regard to arches again, or rather the spaces or openings covered by them, the proportions that are pleasing in some cases are quite unsuitable for others: in spacious apertures of the kind, that is, of considerable breadth as regards the other features, the proportions ought to vary little from a double square in height, or two circles inscribed within the aperture, of which half of the uppermost one will be the outline of the arch; whereas in narrower apertures of the kind, and in arched windows, greater proportionate height is allowable. As in almost every other respect, Gothic architecture affords greater freedom and latitude, not only as regards the form of the arch itself, but also the general proportions of the entire *voiding* covered by it, which may be of lofty proportions in comparison with its breadth; but in the Roman or modern Greco-Roman style (where the arch is adopted together with the Grecian features and detail), other proportions than those above mentioned cannot very well be departed from, because the excess as to height which would produce the grandeur of loftiness would in the same degree occasion the effect of narrowness, narrow and lofty being almost convertible terms as regards proportion. There are cases in which propriety and fitness not only reconcile us to proportions that would else be positively disagreeable, but in which positive admiration is excited by what would in general be termed utter disproportion. Of this we have proof in bridges, where beauty and grandeur are occasioned by proportions that would be absolutely monstrous elsewhere, by arches of prodigious span or width, springing from exceedingly low piers.

As to the internal proportions of buildings, we shall only observe that beauty and harmony of proportions depend very much upon the particular purpose for which an apartment is intended, and also upon the particular character aimed at. Even loftiness and lowness of proportion are not necessarily either a merit or defect, as their being so depends in very great measure not only on the nature of the apartment itself, but also on the architectural treatment of it. Whether in interior or exterior design, it is requisite that the individual features should be not only well proportioned in themselves, but so well balanced and adjusted that the ensemble shall at once produce a pleasing impression upon the spectator; which kind of *eurythmia*, or general harmony of proportions, admits of so many modifications, and depends so greatly upon the precise nature and character of the particular design, that direct precepts avail but little towards its attainment, on which account it must be acquired chiefly by taste guided by study and observation.

PROPORTION, in Music, is either Harmonical or Rhythmical.

Harmonical Proportion is when, of three numbers representing the relations of sounds, the first has the same proportion to the third as the difference between the first and second has to the difference between the second and third; as in the numbers 6, 8, 12; where

$$6 : 12 :: 8-6 : 12-8;$$

that is to say, $6 : 12 :: 2 : 4$.

When four numbers are in Harmonical Proportion, then the first has the same proportion to the fourth as the difference between the first and second has to the difference between the third and fourth; as in the numbers 6, 8, 12, 18; where

$$6 : 18 :: 8-6 : 18-12;$$

that is to say, $6 : 18 :: 2 : 6$.

The proportions of the sounds of the diatonic scale [DIATONIC] are as follows:—

The Key-note . .	1 : [illegible]
2nd . . .	9 : 8
3rd (major) . .	5 : 4
4th . . .	4 : 3
5th . . .	3 : 2
6th .	5 : 3
7th .	15 : 8
8th, or octave	2 : 1

[SCALE; ACOUSTICS.]

Rhythmical Proportion is the proportion, in relation to time or measure, between the notes representing duration. Thus, the semibreve to the minim is 2 : 1; the semibreve to the crotchet, 4 : 1; the minim to the semiquaver, 8 : 1; &c. That is, the semibreve is twice as long in time as the minim; four times as long as the crotchet, &c.

PROPORTIONAL COMPASSES. [COMPASSES.]

PROPORTIONAL LOGARITHMS, also called logistic logarithms. Suppose it frequently required to calculate the fourth term of a proportion of which the first term is one given quantity, say A: that is, required a fourth proportional to A, p, and q. Common logarithmic calculation here requires three inspections of the table, one addition, and one subtraction. But if A be always the same thing, a new table may be framed, which shall only require two inspections and one addition, as follows:—Opposite to p in the table, write log A − log p instead of log p, and call the former the proportional logarithm of p, which must be considered as the abbreviation of 'logarithm of p proper to be used in proportions of which the first term is A.' The rule then is;—to find a fourth proportional to A, p, and q, add the proportional log. of p to that of q, and the sum is the prop. log. of the answer. For log A − log p, and log A − log q, added together, give

$$\log A - \log \frac{pq}{A};$$

which is, by definition, the prop. log of $pq \div A$, the answer required.

In tables made to be used with the old Nautical Almanac, in which the moon's motion was given for every three hours, A was made = 3^h = 10800^s; and p and q were given in the table, not in seconds, but reduced to hours, minutes, and seconds, Thus the question—

$$3^h : 1^h\,23^m\,18^s :: 14^m\,13^s : x,$$

could be answered, and x found, by two inspections and an addition. But the convenience of this table lay much more in the arrangement into hours, minutes, and seconds, than in the nature of the substitute for the logarithm: and since a similar arrangement is now made to accompany common tables of logarithms, it may be doubted whether the day of logistic logarithms is not past.

PROPORTIONAL PARTS, a name given in logarithmic and other tables to small tables which are annexed to the differences of the tabular number, and which consist merely in setting down the several tenths of the differences or the nearest whole numbers to them. Thus, in the case of 953, the table of proportional parts is as follows:—

	953
1	95
2	191
3	286
4	381
5	477
6	572
7	667
8	762
9	858

Thus, 286 is the whole number nearest to 3-tenths of 953; from which we infer that 29 is the whole number nearest to 3-hundredths of 953. If then we would have ·74 of 953 to the nearest whole number, we take

7 tenths	.	667
4 hundredths	.	38
		705

or 705 is the nearest whole number required, subject to the possibility of an error of a unit, which is of no consequence in the matters for which such tables are used. This is the process required in logarithmic interpolation, when tables of seven decimal places are used.

PROPORTIONS, DEFINITE. [Atomic Theory.]

PROPOSITION. [Organon.]

PROPYLÆA. [Civil Architecture.]

PROROGATION. [Parliament, p. 271.]

PROSE comprehends any species of composition which is not written in metre. Modern writers have differed much respecting what constitutes the distinction between prose and poetry. Many writers maintain that the whole class of compositions, which have pleasure for their *main* object, ought to be regarded as poetry; but Whately, on the other hand, contends that metre is the essence of poetry, and consequently defines poetry as 'elegant and decorated language, in metre, expressing such and such thoughts,' and good prose-composition 'such and such thoughts expressed in good language' (*Rhetoric*, p. 348). [Poetry.]

PRO'SELYTE (*προσήλυτος*, connected with *προσέρχομαι*, *to come to*), a new comer. This word is not found in classical Greek, but occurs many times in the Septuagint, and a few times in the New Testament. It answers to the Hebrew, גֵּר, a stranger. 'Proselytes,' says Suidas, 'are they who have come out of the Gentiles, and live according to the divine laws.' The word is applied almost exclusively to persons converted to the religion of the Jews. Of proselytes, two kinds are mentioned by Jewish writers, proselytes of the gate, who observed only a few prescribed rules, and proselytes of righteousness, who followed the entire Mosaic ritual; but such a distinction does not appear to be recognised in the Scriptures. (Joseph Mede's *Discourses*.)

PROSE'RPINA, called by the Greeks Persephone (*Περσεφόνη*) and Persephoneia (*Περσεφόνεια*), was the daughter of Zeus and Demeter. (Hesiod, *Theog.*, 913.) She was carried off by Pluto while gathering flowers in the Nysian plain (Homer, *Hymn in Demet.*, 17), and made the queen of the regions of the dead. Demeter, inconsolable for the loss of her daughter, afflicted the world with sterility; till at length Zeus consented to the return of Proserpina to her mother; but as she had eaten food in the regions below, she was obliged to spend one third of the year with Pluto, and was allowed to pass the other two-thirds with Demeter. The tale of the rape of Proserpina is related at length in the Homeric Hymn to Demeter, and by Ovid and Claudian. The last two writers state that Proserpina was gathering flowers near the city of Enna in Sicily, when she was carried off by Pluto. In Homer, Persephonè is mentioned as the goddess of Hades (*Od.*, xi. 217); but her rape by Pluto is not mentioned either in the 'Iliad' or 'Odyssey.'

Proserpina is frequently called Kora (*Κόρη*), that is, the 'Maiden,' by the Attic writers. This goddess and her mother Demeter were also worshipped under the name of the 'Great Goddesses' (*αἱ μεγάλαι θεαί*, Pausan., viii. 31, § 1).

The etymology of Persephone and Proserpina is doubtful. Some writers connect her name with *φέρω*, *φέρβω*, 'to feed,' and *φάω*, *φαίνω*, 'to show,' and interpret it to mean the 'shower of food,' in allusion to her being the daughter of Demeter; but this explanation is far from satisfactory. [Demeter; Pluto.]

PROSI'MIA, the name given by Brisson and Storr to some of the *Lemurs*. [Lemuridæ.] The *Prosimii* of Illiger (belonging to his *Pollicata*) consist of the genera *Lichanotus*, *Lemur*, and *Stenops*.

PRO'SODY (*προσῳδία*) is derived from a Greek word, which has exactly the same meaning as the Latin *accentus*, and was used by the Greeks in the same sense. (Quintil., *Inst. Orator.*, i. 5, p. 38, ed. Bipont.; Aulus Gellius, xii. 6.) Most modern writers however make a distinction between prosody and accent, understanding by the former what is usually called *quantity*, that is, the duration of a sound. Thus it is said that the principle of Greek and Roman versification is *quantity*, while that of the poetry of the modern European languages depends on *accents*. It is not however improbable that what the antients meant by *quantity* was not very different from what we call *accent*. [Accent.] For further information on this subject the reader is referred to an able article in the fourth volume of the 'Journal of Education,' p. 337, &c.; and to the article Oratory.

PRO'SOPIS, a name which occurs in Dioscorides, and which has been injudiciously applied to a tropical genus, without any proof of the species of this, having any resemblance to the original plant. The genus consists of trees or shrubs, with flowers in spikes, pinnate much-divided leaves, with or without thorns, and edible legumes, of which several are found in South America, and called algaroba by the Spaniards. One species is found in India, which resembles the South American species in its legume, when ripe, containing, besides the seeds, a large quantity of a brown mealy substance, which is eaten by the natives of the country. This species, known to the natives by the name of Chanee, grows to the size of a tree, and is found in the interior of the peninsula of India, as well as in the north-western provinces. It was referred to Adenanthera by Dr. Roxburgh. The genus is characterised by having polygamous flowers, a five-toothed calyx, five free petals, ten stamens, with the filaments scarcely united at the very base. Legume continuous, filled with pulp, linear, cylindrical, slightly compressed, torulose, at length crumbling to pieces. It is the above pulp which is edible both in India and in South America.

PROSTYLE. [Civil Architecture.]

PROTA'GORAS was born at Abdera in Thrace, and is said to have been originally a porter, and to have received instruction from Democritus, who was so pleased with the skilful manner in which Protagoras arranged his load, that he afforded him the means of prosecuting the study of philosophy. Some modern writers have disbelieved the whole account, but it seems certain, from the unanimous testimony of the antients, that Protagoras was of an [illegible]erior condition in life, and owed his education to Democritus. (Aul. Gell., v. 3; Diog. Laert., ix. 50, 53; Athenæus, viii., p. 534, e.; Suidas, &c.) The principal circumstance which has led some writers to doubt whether Protagoras ever received instruction from Democritus arises from the fact that the former was in all probability older than the latter. Democritus was born B.C. 460. [Democritus.] Plato represents Socrates in the 'Meno' (c. 29, p. 91) speaking of Protagoras as already dead, and also states that he lived nearly seventy years. Now as Socrates died B.C. 399, Protagoras, according to this account, must have been born at least as early as B.C. 470, though the carelessness of Plato on such subjects renders this by no means certain. Philochorus however, according to Diogenes Laertius (ix. 55), said that the death of Protagoras was alluded to in the 'Ixion' of Euripides, which must consequently have happened before that of Euripides, that is, before the end of B.C. 406. If however both these statements can be depended upon, there is still no reason for disbelieving that Protagoras received instruction from Democritus; for, as Mr. Clinton has remarked, Democritus, who belonged to one of the most eminent families at Abdera in rank and station, might discern the merit and encourage the genius of Protagoras, although younger himself than Protagoras.

None of the writings of Protagoras have come down to us; but it is evident that he was a man of great powers of mind. Some of his doctrines are discussed in the 'Theætetus' of Plato. [Plato, p. 237.] He travelled through Greece for the purpose of giving instruction in philosophy and eloquence, and is said to have been the first person who adopted the name of Sophist (*σοφιστής*), to distinguish more decidedly one who made others wise, especially one who taught eloquence and the political art. He is also said to have been the first among the Greek philosophers who received money for the instruction which he gave. Wherever he went, he was sure to obtain numbers of pupils; and Plato, in the dialogue entitled 'Protagoras,' has given an amusing account of the enthusiasm with which he was received by the young men at Athens on his visit to that city. Diogenes Laertius says (ix. 52) that his instruction was so much in demand, that he sometimes received a hundred minæ; and Plato informs us (*Meno*, c. 29, p. 91) that, during the forty years in which Protagoras taught, he made more money than Phidias and ten other sculptors.

Protagoras visited Athens at least twice. Two of his visits are spoken of by Athenæus and Plato (Athen., v., p. 218, b; xi., p. 506, a; *Protag.*, c. 5), and the date of his second visit is determined by the former writer, who says (v., p. 218, c) that it took place after the Κόννος of Ameipsias and before the Κόλακες of Eupolis, that is, between B C. 423 and 421. During one of his visits to Athens, probably subsequent to those which have been mentioned, he was banished from the state, and his books burned in the market-place, because he had stated at the beginning of one of his works that he did not know whether the gods existed or not. (Diog. Laert., ix. 51, 52; Cic., *De Nat. Deor.*, i. 23.) According to some accounts, he was drowned in his passage to Sicily, and, according to others, died on the voyage. (Diog. Laert., ix. 55.)

Protagoras appears to have been the first who taught oratory as an art. He possessed, if we may judge from the specimen given by Plato in the 'Protagoras,' a lively imagination and great copiousness of words. He was well acquainted with the literature of his own country, especially the works of the antient poets, whom he frequently quoted in his speeches, which appear to have been very popular. He is said to have taught Isocrates, and his oratorical exercises are referred to by Cicero, who says that they were called in his time 'communes loci' (*Brut.*, c. 12). Protagoras was the first who introduced artificial divisions into discourses. (Diog. Laert., ix. 53, 54.) He also appears to have written works on language and oratory: his ὀρθοέπεια, which is referred to by Plato (*Phædr.*, c. 114, p. 267), is supposed by Spengel (*Συναγωγὴ τεχνῶν*, p. 40, Stuttgardt, 1828) to have been a work of this description. A list of the writings of Protagoras is given by Diogenes Laertius (ix. 55) and Fabricius (*Bibl. Græc.*, vol. ii., p. 668, ed. Harles). Cicero refers to his work 'On the Nature of Things' (*De Orat.*, iii. 32).

For further information on the Life of Protagoras, the reader is referred to Herbst, *Des Protagoras Leben und Sophistik aus* [illegible] *Quellen zusammengestellt*, in Petersen's Phil.-Histor. Studien auf dem Akad. Gymnasium in Hamburg,' Hamburg, 1832, heft i., p. 88.

PROTEA'CEÆ. [Xylomelum.]

PROTECTOR. [Settlement.]

PROTELES. [Aard-Wolf.]

PROTEOSAU'RUS. [Ichthyosaurus.]

PROTEST. [Bill of Exchange; Notary; Parliament.]

PROTESTANT, a general term comprehending all those who, professing Christianity, yet are not in the communion of the general church or confederacy of Christians of which the pope is the head and the city of Rome the centre or capital. There is great variety of opinion among persons thus separated, in points of faith, church order, and discipline, but this term covers and comprehends them all, leaving the varieties in opinion to be marks of specific differences only under the genus Protestant.

The term originated in Germany, and the occasion was this:—At the diet at Spire, in 1526, decrees had been passed which were so far favourable to the progress of the Reformation that they went to forbid any peculiar exertions against it. The consequence was that the spirit of reformation gained strength, and spread itself more extensively in Germany. Then arose also commotions which were attributed to the reformed and to the spirit kindled by them. Both the pope and the emperor looked with increasing alarm on the aspect of affairs, and at another diet, held at the same place in 1529, the emperor directed an imperial brief to the persons assembled, to the effect that he had forbidden all innovation, and proscribed the innovators in matters of religion, who had notwithstanding increased since the decrees of 1526, but that now, by virtue of the full powers inherent in him, he annulled those decrees as contrary to his intentions. The peremptory tone of these letters alarmed the persons present at the diet; and particularly the elector of Saxony is reported to have said to his son that no former emperor had used such language, and that he ought to be informed that their rights were more antient than the elevation of his family.

This strong measure of the emperor had also the effect of uniting, at least on this point, the two great sections of German reformers, the Lutherans and the Sacramentarians, of whom Zuinglius was the head. However the party opposed to the Reformation was the stronger, and the emperor's brief received the sanction of the diet. Then it was that the reformers took the high ground of declaring that this was not a business of policy or temporal interests, with respect to which they were ready to submit to the will of the majority, but it affected the interests of conscience and futurity. On this and other grounds they founded a *protest*, which was delivered in on the 19th day of April, but refused by the rest of the diet. A second protest, larger than the former, was presented on the succeeding day. The princes and the cities who favoured the Reformation joined in it, and thenceforth it became usual to call the reformers *Protestants*.

It is often found that a particular incident or occasion leads to the construction of a name for a religious party, which becomes extended, as in this instance, to parties who have no immediate connection with the particular incident, or interest in the question with which it is connected. The term Protestant in fact seems to have as much to do with the constitution of the Germanic confederacy as with the principles of the Reformation; and certainly neither England nor Scotland had any thing to do with the proceedings of the emperor or with the diet of Spire. The Reformed Church might seem to designate the church of England or the church of Scotland more appropriately than the Protestant church. However it must be owned that few things are more difficult than to coin terms by which to designate a religious community which shall not be open to objection and cavil.

PROTEUS, Laurenti's name for one of the genera of *Perennibranchiate Batrachians*, namely, those *Batrachians* which preserve their branchiæ throughout life, whereas the *Caducibranchiate Batrachians* only possess them during their early or tadpole state. [Frogs.] This preservation of the branchiæ does not interfere with the presence of true lungs, so that these *Perennibranchiata* may, as Cuvier observes, be regarded as the sole vertebrated animals that are truly amphibious. The same distinguished comparative anatomist says: 'The simultaneous existence and action of branchial tufts and lungs in these animals can no more be contested than the most certain facts of natural history: I have before me the lungs of a *Siren* of three feet in length, where the vascular apparatus is as much developed and as complicated as in any reptile: nevertheless this *Siren* had its *branchiæ* as complete as the others.' [Siren.] Cuvier further observes that whilst the branchiæ subsist, the aorta, in coming from the heart, is divided into as many branches on each side as there are *branchiæ*. The blood of the *branchiæ* returns by the veins, which unite towards the back in a single arterial trunk, as in the fishes; it is from this trunk, or immediately from the veins which form it, that the greatest part of the arteries which nourish the body, and even those which conduct the blood for respiration in the lung, spring. But in the species which lose their *branchiæ* naturally, the branches which go there become obliterated, except two which unite in a dorsal artery, and of which each gives off a small branch to the lung. 'It is,' adds Cuvier, 'the circulation of a fish metamorphosed into the circulation of a reptile.'

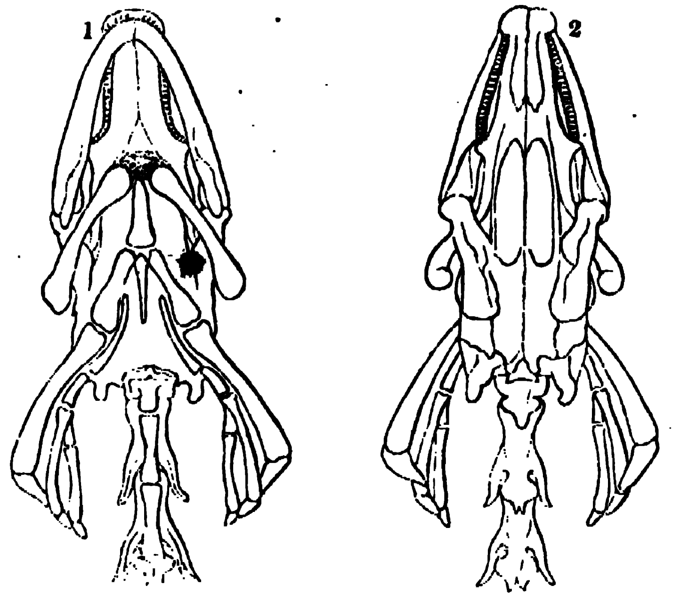
The genera of these *Amphibia*, or *Proteidea*, as they have been termed, are the *Axolotls* [Axolotl]; *Menobranchus*, Harlan [Necturus]; *Proteus*, of which we are about to treat; and *Siren* which will be noticed under that title.

ORGANIZATION.

The *Proteus* of Laurenti (*Hypochton* of Merrem) has four feet. There are three toes on the anterior feet and two only on the posterior feet. The skeleton bears considerable resemblance to that of the *Salamanders*; indeed, Cuvier, we believe, has somewhere termed the fossil *Salamandra gigantea*, the *Homo diluvii testis* of Scheuchzer, *Protée gigantesque*: but *Proteus* has many more vertebræ than the Salamanders, and less of the rudiments of ribs, and bony head is entirely different from theirs in its general conformation.

But one species of *Proteus* appears to be known, the *Proteus anguinus* of authors, *Hypochton Anguinus*. Cuvier describes it as more than a foot long, of the size of a human finger, with a tail vertically compressed, and four little legs; the muzzle elongated and depressed; both of its jaws furnished with teeth;* the tongue with but little motion, but free in front; the eyes excessively small and hidden by the skin, as in the Rat-Mole (*Spalax*); the ears covered by the flesh, as in the Salamander; its skin smooth and whitish.

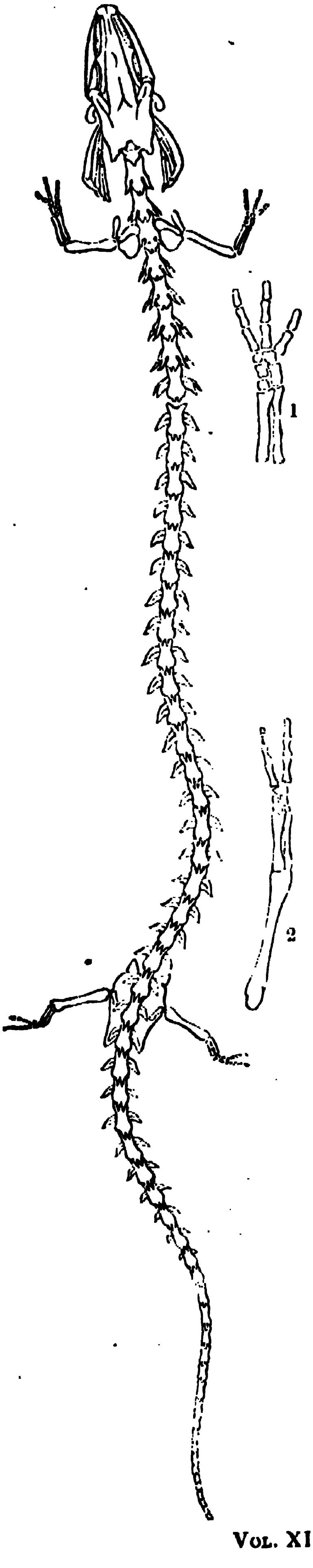
Those which we have seen alive have been of a light flesh-colour with coral-red branchiæ.



1, Skull, &c., and three first vertebræ, of the Proteus, seen from below. 2, Same seen from above, eight times larger than nature. (Rusconi.)

In November, 1837, Dr. Martin Barry, of Edinburgh, exhibited one of these singular and interesting animals, living, to the Zoological Society of London, and read the following communication from Professor Rudolph Wagner, of Erlangen in Bavaria:—

'I was so fortunate'—it is the Professor who speaks—'at the end of last summer, as to obtain three living *Protei*; of which I have examined two, just killed, that proved to be a male and female, and have given the third, alive, to my friend Dr. Barry, who may perhaps have an opportunity of bringing it forward at a meeting of the Zoological Society. The results of my examination correspond perfectly with the statements of Cuvier, R. Owen, J. Müller, and others, on the *Proteidea*; but are opposed to several of the views lately put forth by Rusconi. (*Observations sur la Sirène*, 1837.) I have, for instance, no doubt that the pulmonary sacs or vesicles really perform the function of lungs. Each lung contains a large artery and a still larger vein, which are connected together by means of large and numerous vessels. To me the most important point was the examination of the blood-globules and the generative organs. I conjectured, on various grounds, that the *Proteidea* would be found to have, of all animals, the largest blood-globules:—first, because the size of the latter in the naked *Amphibia* in general is the largest in the animal kingdom; secondly, because, remarkable as it is, the blood-globules are here (in the naked Amphibia) so much the larger, the longer the gills continue in the larval state; hence the land and water salamanders have much larger blood-globules than the frog. I conjectured also that the *Protei* (probably also the *Siren*, &c.), because they permanently have both gills and lungs—being therefore permanently *larvæ*—would be found to have the largest blood-globules. The latter are indeed gigantic; flat, oval, resembling those of the salamander, and from $\frac{1}{36}$ to $\frac{1}{40}$ of a Paris line in length; hence, as minute points, visible to the naked eye. They are from once to twice the size of the blood globules of the salamander, nearly three times as large as those of the frog, and about twelve or fifteen times the size of those of man. In a female I found the *ova* very beautifully developed; their structure, as well as that of the ovary, corresponding perfectly with that of the other naked *Amphibia*, especially the *Triton*. The smallest *ova* consist of a delicate *chorion*, yellow yolk, large germinal vesicle, and *manifold* germinal spot. I regret to say that in the otherwise tolerably developed testes of the male there were no *spermatozoa*. I conjecture however that the *spermatozoa* of this animal resemble those of the *Triton*. I would just remark, that the form and size of the blood-globules, the formation of the *ova*, and the form of the *spermatozoa*, in different animals,



Skeleton of Proteus, seen from above. 1, bones of anterior foot, magnified. 2, bones of posterior foot, magnified. (Rusconi.)

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* Mr. Swainson (*Classification of Amphibians*) erroneously states that it has no teeth. See the cut, and Professor Owen's work on the teeth, where a figure of those of *Proteus* is given.

have a great zoological and physiological interest. Already is it in my power from a drop of blood or *semen* placed before me, to determine with the microscope, not only the class, but frequently the genus and the species from which these fluids have been taken.'

Dr. Barry then stated that, from his own microscopical examination, he was able fully to confirm the correctness of Professor Wagner's observations upon the size and shape of the blood-globules in the *Proteus*. (*Zool. Proc.*, 1837.)

Locality, Habits, &c.—Sir Humphry Davy, in his 'Consolations in Travel,' gives a very graphic account of finding these subterranean aquatics in Illyria. In a conversation given as taking place in the Grotto of the Maddalena at Adelsberg, many hundred feet below the surface, after a lively description of that extraordinary cavern, *Eubathes*, one of the prolocutors, says, 'I see three or four creatures, like slender fish, moving on the mud below the water.'

'*The Unknown.*—I see them; they are the *Protei;* now I have them in my fishing-net, and now they are safe in the pitcher of water. At first view, you might suppose this animal to be a lizard, but it has the motions of a fish. Its head and the lower part of its body and its tail bear a strong resemblance to those of the eel; but it has no fins,* and its curious branchial organs are not like the gills of fishes; they form a singular vascular structure, as you see, almost like a crest, round the throat, which may be removed without occasioning the death of the animal, which is likewise furnished with lungs. With this double apparatus for supplying air to the blood, it can live either below or above the surface of the water. Its fore feet resemble hands, but they have only three claws or fingers, and are too feeble to be of use in grasping or supporting the weight of the animal; the hinder feet have only two claws or toes, and in the larger specimens are found so imperfect as to be almost obliterated. It has small points in place of eyes, as if to preserve the analogy of nature. It is of a fleshy whiteness and transparency in its natural state, but when exposed to light, its skin gradually becomes darker, and at last gains an olive tint. Its nasal organs appear large; and it is abundantly furnished with teeth, from which it may be concluded that it is an animal of prey; yet in its confined state, it has never been known to eat, and it has been kept alive for many years by occasionally changing the water in which it was placed.'

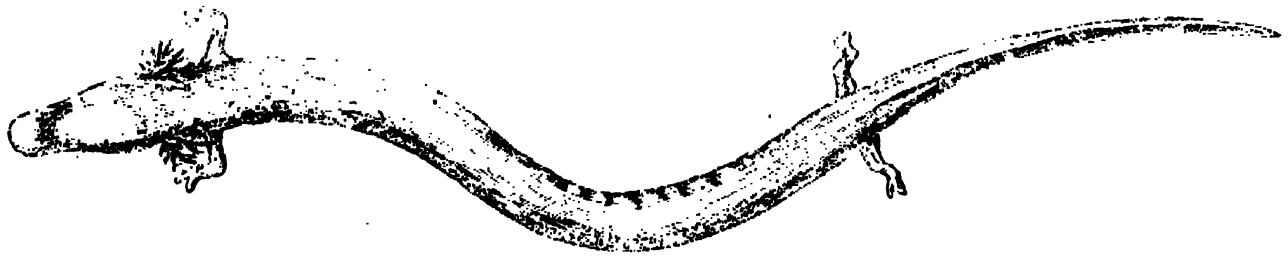
Eubathes.—'Is this the only place in Carniola where these animals are found?'

The Unknown.—'They were first discovered here by the late Baron Zöis; but they have since been found, though rarely, at Sittich, about thirty miles distant, thrown up by water from a subterraneous cavity; and I have lately heard it reported that some individuals of the same species have been recognised in the calcareous strata in Sicily.'

Eubathes.—'This lake in which we have seen these animals is a very small one; do you suppose they are bred here?"

The Unknown.—'Certainly not; in dry seasons they are seldom found here, but after great rains they are often abundant. I think it cannot be doubted that their natural residence is in an extensive deep subterranean lake, from which in great floods they sometimes are forced through the crevices of the rocks into this place where they are found; and it does not appear to me impossible, when the peculiar nature of the country in which we are is considered, that the same great cavity may furnish the individuals which have been found at Adelsberg and at Sittich.'

Eubathes replies, 'That this is a very extraordinary view of the subject, and proceeds to inquire whether it is not possible that it may be the larva of some large unknown animal inhabiting those limestone cavities?"—which ingenious theory the *Unknown* very properly disposes of by showing that it is not an animal in a state of transition, but a perfect animal of a peculiar species.



Proteus anguinus.

With reference to the subject of this article, the student should carefully go over Professor Owen's paper on the *Lepidosiren annectens*, in the eighteenth volume of the 'Linnean Transactions.' This most interesting animal, though undoubtedly a fish, is one of those beautifully fine and harmonious links by which the whole golden chain of nature is connected. We direct attention to one or two points in the structure of this *Proteideous* fish. In *Lepidosiren* the nostrils are situated at the under part of the upper lip, within the opening of the mouth. They appear as two small perforations leading to blind sacs. In the *Siren*, as well as in the *Proteus*, Cuvier expressly states that the nasal cavities communicate with the mouth.

The muscles of the trunk of the *Lepidosiren* present, Mr. Owen tells us, all the simplicity and uniformity characteristic of the class of fishes; the ventral series occupy the place of the true abdominal muscles, which first begin to be developed in the strictly air-breathing Reptiles. The muscles of the mandibular, hyoidean, branchial, and scapular arches resemble in some points the arrangement of the same muscles in the Perennibranchians, and in other points that in the true fishes; and, notwithstanding the entirely fish-like disposition of the muscles of the trunk, the lower Perennibranchians and the larvæ of the higher Batrachians offer, he observes, a similar agreement in this part of their organization to the class of fishes. Again, we are told that the brain bears a closer resemblance to that of the Perennibranchiate Reptiles than to the brain of any fish that has yet been described. In the low development of the cerebellum and in the large size of the pineal gland, the *Lepidosiren* deviates remarkably, both from the osseous and cartilaginous fishes. The orifice of the pharynx is much smaller and more suddenly contracted than in fishes generally, or the Perennibranchiate Reptiles. The abdominal cavity, which commences about half an inch behind the pectoral filamentary fins, and extends about half an inch beyond the anus, is separated anteriorly from the pericardiac cavity, as in fishes and Perennibranchiate Reptiles, by a distinct transverse septum. The heart of *Lepidosiren* consists of a single auricle, a ventricle, and a *bulbus arteriosus.* The *vena cava* terminates in the right side of the large auricle; it is joined by two superior *cavæ*, and by the single large pulmonary vein; this vein does not however communicate with the sinus, but passes along entire and adherent to the inner surface of the *vena cava*, as far as the auriculo-ventricular aperture, where it empties its contents into the ventricle by a distinct orifice, protected by a cartilaginous valvular tubercle. 'It needed only,' proceeds Mr. Owen, 'that the pulmonary vein should have been dilated before its termination, in order to have established a biauricular structure of the heart, as in the *Siren*. The same functional advantage is however thus secured to the *Lepidosiren*, with the maintenance of the simple dicœlous type of the heart of the fish; the continuation of the pulmonary vein preventing the admixture of the respired with the venous blood, until both have arrived in the ventricle.' The *branchiæ* of the *Lepidosiren*, it appears, resemble in form those of the *Siren*, consisting of separate elongated filaments, attached only by one extremity to the branchial arch; but these extremities are fixed directly to the branchial arch, and not to a common pedicle extended therefrom, as in the *Siren*. Viewed with a moderate lens, Professor Owen found the tripinnatifid structure beautifully displayed in each branchial filament. The gills do not form any external projection, as in the gill-bearing Perennibranchians, but although the organs for respiration through the medium of water correspond in all essential points with those of the true fishes, yet the gills approximate in their filamentary form to those of the Perennibranchiate Reptiles. The *tra-*

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* It has a sort of tail fin.

chea, too, or *auctus pneumaticus*, is a short, wide, membranous tube, as in the Perennibranchiate Reptiles, and there are regular lungs, but having the same relative position as the air-bladder of fishes.

Our limits will not permit us to go further into this interesting comparison, but we particularly recommend attention to the concluding observations of the Professor's acute, accurate, and satisfactory memoir. [PROTOPTERUS.]

PROTOCACCUS. [SNOW, RED.]

PROTO'GENES (Πρωτογένης), one of the most celebrated of the Greek painters, was born at Caunus in Caria, a town subject to the Rhodians. Suidas says that Protogenes was a native of Xanthus in Lycia; but this appears to be a mistake, since he is called a Caunian by Pausanias (i. 3, § 4), and is expressly said by Pliny (*Hist. Nat.*, xxxv. 36, § 20) to have been born at Caunus. He was a contemporary of Apelles, and was at the height of his reputation in the 112th Olympiad, that is, about B.C. 332. (Plin., *Hist. Nat.*, xxxv. 36, § 10.) He lived at Rhodes during the greater part of his life.

Pliny says that Protogenes was originally in very poor circumstances, and that it was not known from whom he received instruction. He did not produce many paintings, in consequence of the long time and great labour which he devoted to each. Quintilian (*Inst. Orat.*, xii. 10, p. 369, Bipont) says that 'cura' was the distinguishing characteristic of his paintings; and Apelles is said to have remarked that Protogenes did not know when to take his hand from his pictures. (Plin., *Hist. Nat.*, xxxv. 36, § 10.) Of all the paintings of Protogenes the most celebrated was the one called Ialysus, upon which he is said to have been engaged seven years. (Ælian, *Var. Hist.*, xii. 41.) Pliny says that he lived, during the time he was painting it, upon moistened lupines, and also informs us that each colour was laid on four times. A dog in this painting, which was represented panting and foaming at the mouth, was greatly admired. It is related that Protogenes was for a long time unable to represent the foam in the manner which he wished, till at length, disheartened by repeated failures, he threw his sponge at the mouth of the dog, which accidentally produced the effect he had been endeavouring to obtain. The fame of this painting was so great, that Demetrius Poliorcetes, when besieging Rhodes, did not set fire to that part of the city where Protogenes lived, lest he should destroy the picture. (Plin., *Hist. Nat.*, vii. 39; xxxv. 36, § 20.) Aulus Gellius, in relating the same circumstance, says (xv. 31) that Protogenes was dead, and that the painting was preserved in a public library outside the walls of the town. In the time of Pliny it was preserved in the temple of Peace at Rome.

Among the other paintings of Protogenes mentioned by Pliny was a portrait of the mother of Aristotle, who advised him to paint some of the exploits of Alexander the Great. Paintings of Alexander and of Pan were among the last of his works. Pausanias (i. 3, § 4) also mentions a painting of the Thesmothetæ by Protogenes, which was preserved at Athens in the senate-house of the Five Hundred (βουλευτήριον).

Protogenes is always mentioned by the antient writers in terms of the highest admiration. (Petron., *Sat.*, c. 83; Cic., *Brut.*, 18; *Ad Att.*, ii. 21; Varro, *De Ling. Lat.*, ix. 12, ed. Müller; Columella, *De Re Rust.*; Præf. in lib. i., p. 21, Bipont.) He is said by Pliny to have also executed works in bronze.

Suidas says that Protogenes wrote two books on the art of painting and on figures (περὶ γραφικῆς καὶ σχημάτων).

(Junius, *Catalogus Architectorum, Mechanicorum, Pictorum*, &c., Art. 'Protogenes,' Roter., 1694.)

PROTO'PTERUS. Under this name Professor Owen, in the MS. catalogue of the Museum of the College of Surgeons, in June, 1837, recorded the principal characters of an extraordinary animal which he supposed to belong to the Malacopterygious fishes. In the same year, Dr. Natterer published an account of a nearly allied animal under the name *Lepidosiren paradoxa*. This account appeared in the annals of the Museum of Vienna,* and is drawn up from two specimens discovered by the author of the paper in South America. The memoir of Dr. Natterer on the South American *Lepidosiren* was followed by one from Professor Owen, in the 'Linnean Transactions' (vol. xviii., part 2, p. 327), in which that anatomist describes in detail both the external characters and internal anatomy of the *Protopterus* above mentioned; and as he found this animal must be referred to the same genus as that discovered by Dr. Natterer, he adopted his generic term, and applied the name of *Lepidosiren annectens* to the species. The last-mentioned animal, says Professor Owen, 'was presented to the Royal College of Surgeons, June, 1837, by Thomas C. B. Weir, Esq., together with a smaller dried specimen enclosed in indurated clay baked hard by the sun. Several species of insects peculiar to the Gambia, or African forms, accompanied these specimens.' 'It is a female, with the ovaria well developed, and measures twelve inches eight lines in length; its greatest circumference is four inches and a half. The head commences by an obtuse muzzle, and gradually enlarges in all its dimensions to the gill-openings, which are situated immediately anterior to the base of the pectoral extremities: the length of the head, from the snout to the gill-opening, is one inch eleven lines. The anus, or rather the cloacal vent, is a small elliptical aperture marked with radiating lines, which is situated three lines behind the ventral filaments, and offers the same peculiarity as does that of the *Lepidosiren paradoxa* in not being situated on the median plane; in the present specimen it was on the right side of a longitudinal fold of integument which occupied the middle line. The distance from the vent to the end of the tail is five inches. The trunk gives a wide elliptical transverse section, and maintains a pretty uniform size, slightly decreasing in breadth to the ventral filaments. Beyond these the tail becomes more rapidly compressed, and after a short distance diminishes also in vertical dimension, till it ends in a thin point. A membranous dorsal fin commences at the distance of four inches from the snout, and, gradually increasing to the height of five lines, is thus continued into the caudal membranous expansion. This fin is supported by numerous soft, elastic, transparent rays, articulated to the extremities of the superior and inferior peripheral spines of the caudal vertebræ; the under part of the caudal fin commences about one inch behind the vent. The entire body is covered with cycloid scales, which are relatively larger, but have the same general structure and disposition as in the *Lepidosiren paradoxa*. They present a subcircular form, with a diameter of about three lines; their posterior margin adheres to the strong cuticle with which they are removed, as in other fishes; the anterior lies freely in a corresponding groove of the chorion. When viewed with a low magnifying power, they present a series of canals radiating somewhat irregularly from a centre near the posterior edge of the scales, and maintaining a uniform diameter. These canals are united together by cross canals, which do not form regular concentric lines. The meshes formed by this reticulation are small and of a subquadrate form at the anterior part of the scale, but are more elongated in the middle of the scale: they are again smaller and shorter at the circumference. With a magnifying power of 150 linear diameters, the interspaces of the larger canals are seen to be occupied by a finer network of apparent tubes, and from an angle of each of these spaces a short obtuse process, projecting slightly backwards, is developed on the external surface of the scale; the internal surface is quite smooth. There are three or four faint concentric lines of growth at the circumference of the scale, but this body is evidently one continuous organised whole. The subcuticular tissue of the scale is a kind of dense elastic cartilage, not yielding any gas bubbles on the application of acid. The scales are continued upon the base of the caudal natatory fold of integument.

'The disposition of the mucous pores and ducts upon the head is very similar in the two species of the *Lepidosiren*, judging from the figure given by Dr. Natterer. A linear series of mucous pores encircles each eye, and from the posterior angle of this series the lateral line commences. This line extends backwards nearly parallel with the dorsal line, situated a little more than one-fourth of the vertical diameter of the body of that line, until it nearly reaches the ventral extremities, where it bends down to midway between the dorsal and ventral margins, and so continues to the end of the tail.

'The rudimentary filamentary fins, the analogues of the four ordinary extremities in the Vertebrata, permanently represent in the present singular animal the earliest embryonic condition of the pectoral and pelvic members.

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* '*Lepidosiren paradoxa*, eine neue Gattung, aus der Familie der Fischähnlichen Reptilien, von Johann Natterer,' in 'Annalen des Wiener Museums der Naturgeschichte,' 1837, ii., p. 166.

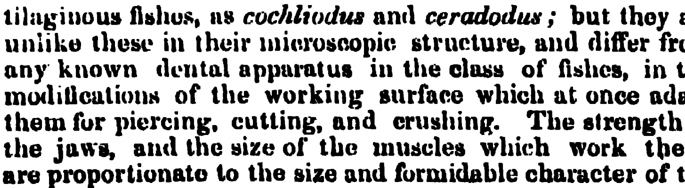
They are round, filiform, gradually attenuated to an undivided point, resembling tentacles or feelers rather than fins or legs, and doubtless restricted to their tactile functions. Each filiform member is supported by a single-jointed, soft, cartilaginous ray. The pectoral tentacles are somewhat shorter and more slender than the ventral ones; the former are two inches, the latter two inches four lines in length.

'The branchial apertures are narrow vertical slits four lines in extent. The eyes appear externally as two small round flat spots of a lighter colour than the surrounding integument; they are situated seven lines from the end of the snout, and nearly the same distance apart from one another. Each of these simple visual organs measures one line and a half in diameter; it is not defended by any palpebral folds of the skin; the cornea is thin, sufficiently transparent to allow the lens to be visible even in the specimen preserved in spirits. The nostrils are situated at the under part of the upper lip, within the opening of the mouth. They appear as two small perforations leading to blind sacs afterwards to be described. The opening of the mouth is wide and defended by well-developed fleshy lips. The skin at the angles of the mouth is thinner than at the rest of its circumference, and the upper lip folds over the lower one from the angle to near the fore part of the mouth; here the lips are thick, smooth, and rounded; the lower lip is the thickest.

'About a line behind the lower lip, between it and the teeth, there project six soft papillose processes, of a triangular form; two of these, which are situated in the middle line, consist of a transverse row of papillæ; the posterior ones are membranous, and the papillæ are confined to their margin and outer surface: they occupy the notches of the broad and strong dental plate.

'Behind the upper lip there are eight similar papillose processes, four on each side; the mesial placed one line behind or within the margin of the lip; the outermost, three lines from the same part; immediately anterior to the interspace of the two outer lamellæ is the orifice of the nostril, which is elliptical, and one line in the long diameter; the olfactory cavity itself is three lines in the long diameter, and its closed posterior part is occupied with two rows of small transverse lamellæ, about twenty in a row, divided by a transverse line.

'There are two small, slender, conical, sharp-pointed and slightly recurved teeth, which project downwards from the intermaxillary bone, to which they are attached by ligaments; and the alveolar border of both the upper and lower maxillaries is armed with a strong trenchant dental plate, anchylosed to the bone, and divided at the middle line so as to form four distinct pieces, two above and two below; each of these teeth or dental plates is impressed on its outside with two notches, extending almost through the whole breadth of the plate, and dividing it into three angular processes, which, from the direction of the notches, appear to radiate from the inner and posterior angle of the tooth: the two anterior divisions in both the upper and lower jaws are the most produced in the vertical direction, and are pointed so as to be adapted for piercing: the posterior divisions are most extended in breadth, and least in height, and terminate in a sharp trenchant edge; the middle divisions present an intermediate structure. These teeth, in their paucity, relative size, and mode of fixation to the maxillæ, resemble those of the chimæra and some of the extinct cartilaginous fishes, as *cochliodus* and *ceradodus*; but they are unlike these in their microscopic structure, and differ from any known dental apparatus in the class of fishes, in the modifications of the working surface which at once adapt them for piercing, cutting, and crushing. The strength of the jaws, and the size of the muscles which work them, are proportionate to the size and formidable character of the maxillary dental plates.



There are no lingual, palatine, pterygoid, vomerine, or pharyngeal teeth.

'The general colour of the specimen was a mixed tint of dark olive-green and brown, growing lighter towards the belly, with irregular dark spots, as big as the largest scales, chiefly confined to the tail: the mucous pores and lines were black.'

The skeleton of this curious fish is partly cartilaginous and partly bony, and the osseous portions are of a green colour, as in the common Gar-fish (*Belone vulgaris*).

In reviewing the principal characters of the skeleton of the *Lepidosiren*, 'we obtain,' says Professor Owen, 'good evidence of its ichthyic nature. If indeed the species had been known only by its skeleton, no one could have hesitated in referring it to the class of fishes; but in that class it would have offered a most singular and interesting combination of the cartilaginous and osseous types.

'The central elements of the vertebral column, the basis of the skeleton, exhibit a persistence of its primitive embryonic condition, such as has hitherto been witnessed only in the sturgeon and cyclostomous fishes; but the superior arches and spinous appendages, instead of retaining the cartilaginous state, are converted into the tough elastic fibrous texture characteristic of the skeleton of fishes. The cranium in like manner presents an extremely novel combination of the cartilaginous and bony states, both as regards its partial ossification and the condition of the ossified parts.

'It is only in the higher cartilaginous fishes, *e.g.* that the maxillary, palatine, and pterogoid bones are blended together to form the simple superior dentigerous arch, or upper jaw. The composition of the lower jaw corresponds with that which characterises most of the osseous fishes, and is more simple than in the Amphibia. The confluence of the cranial vertebræ reminds one of the condition of the skull in the siren: but no vestige of a preopercular bone is present in any of the Perennibranchiates. The sphenoideum basilare, as it exists in the sturgeon, is here seen in its fully ossified state. As the basis of the vertebral column presents a condition analogous to that which characterises the early embryonic periods of the higher vertebrata, so also the extremities retain their simple structure as when they first bud forth, and are devoid of any trace of digital divisions: still the march of development has begun, and we perceive by the numerous joints of the cartilaginous ray, that its direction is towards the ichthyic modification of the great vertebral plan.'

Our limits will not admit of our following Professor Owen through the various peculiarities of the internal anatomy this anomalous animal, which has been regarded by so..... naturalists as one of the *Amphibia*. In many points of its structure it certainly does approach that group of animals, especially in the condition of its air-bladder or lungs and its branchiæ; but as regards the former we find considerable advances are made towards the reptilian structure by some other fishes; and it may be remarked that the present animal still differs widely from the *Amphibia* in possessing distinct large scales. There is another character which it appears is of the highest importance in determining the class to which the *Lepidosiren* belongs, namely, the structure of the nostrils. 'In the organ of smell,' says our author, 'we have at last a character which is absolute in reference to the distinction of fishes from reptiles. In every fish it is a short sac communicating only with the external surface; in every reptile it is a canal with both an external and an internal opening. According to this test, the *Lepidosiren* is a fish; by its nose it is known not to be a reptile; in other words it may be said that the *Lepidosiren* is proved to be a fish, not by its gills, not by its air-bladders, not by its spiral intestine, not by its unossified skeleton, not by its generative apparatus, nor its extremities, nor its skin, nor its eyes, nor its ears, but simply by its nose; so that at the close of our analysis we arrive at this very unexpected result, that a reptile is not characterised by its lungs nor a fish by its gills, but that the only unexceptionable distinction is afforded by the organ of smell.' 'Yet it must be confessed that the physiological consequences of the modifications of the nasal cavity above alluded to, would have been far too insignificant to have established the ichthyic nature of the *Lepidosiren*, if, with coexisting gills and lungs, the modifications of the other organic systems had agreed with those of the Perennibranchians instead of with those of fishes.'

In conclusion the author states, 'From every group of fishes however the *Lepidosiren* is sufficiently distinct to form a type not merely of a genus, but of a family; and in the natural system it forms a link connecting the higher *cartilaginous* fishes with the Sauroid genera *Polypterus* and *Lepidosteus*; and at the same time makes the nearest approach in the class of fishes to the Perennibranchiate reptiles.'

The South American *Lepidosiren* (*L. paradoxa*) greatly resembles the species above described, but differs somewhat in its proportions. The whole length of *L. paradoxa* includes eleven lengths of the head, measured from the end of the mouth to the gill-openings; in the *L. annectens* the total length of the animal includes little more than six lengths of the head. This species is therefore distinguished from the *L. paradoxa* by the shorter relative length of the trunk as compared with the head.

One of Dr. Natterer's specimens of *Lepidosiren paradoxa*, which measured upwards of three feet in length, was found in a swamp on the left bank of the Amazon above Villa Nuova; the other, which was nearly two feet long, was taken in a pond near Borba, on the river Madeira, a tributary of the Amazon.

PROTOROSAU'RUS, M. Hermann Von Meyer's name for the fossil Monitor of Thuringia. (Cuv., *Oss. Foss.*, tom. v., p. 300, et seq. pl. 9, f. 1, 2.)

PROTRACTOR. Any instrument for laying down angles is so called, such as the graduated semicircle which is found in cases of instruments, the rectangular ruler with graduated edges, and various other more expensive contrivances. But the truth is that the easiest and safest protractor is a table of Chords, a scale of equal parts, and a pair of compasses: those who have not a sufficient table of chords should take the chord from a table of sines by the formula—

$$\text{chord of } x = \text{diameter} \times \text{sine of half } x.$$

Even the scale of chords laid down on the rulers, used in the usual manner, is a better protractor than the graduated semicircle, which is worthless, except for very rough work. A good table of chords carried to every minute under 180°, is, we believe, not yet published in this country.

PROVENÇAL. [Provence.]

PROVENCE, a maritime province of France according to the division which existed before the Revolution. It was bounded on the east by the principality of Nice, or Nizza, in Italy, from which it was separated by the Maritime Alps and the river Var; on the north it was bounded by the district of Gapençois in Dauphiné; on the north-west by Le Comtat (or county) Venaissin and Le Comtat (or county) d'Avignon [Comtat, Le]: on the west by Languedoc, from which it was separated by the Rhône; and on the south by the Mediterranean Sea. Its greatest length was from east by north to west by south, between the two extremities of the coast-line, 152 to 155 miles; its greatest breadth from the coast inland 97 miles. Few of the provinces of France possessed greater variety of soil and climate than Provence. The plains, sheltered on the northern and eastern sides by the branches of the Alps, and the lower slopes of the mountains which had a southern exposure, produced fruits which were not found in other parts of France, at least not of equally fine quality, as the orange, the lemon, the pomegranate, the almond, the olive, &c. The length of coast-line on the Mediterranean Sea induced at an early period a commercial spirit upon the people, and contributed to the revival of letters and refinement earlier than in the rest of France.

The subdivisions of Provence were fiscal, judicial, or ecclesiastical. While the provincial states-general continued, viz. until 1639, there were two principal fiscal divisions: the first was called Le Pays des Vigueries; and the second included the four districts of La Vallée (the Valley) of Barcelonette, Le Val de Barrême, Le Comté de Sault, and Les Communautés des Terres adjacentes et Villes franches. Les Vigueries (the Magistracies) were twenty-one, viz. those of Aix (22,575), Annot, Apt (5707), Aulps (3083), Barjols (3512), Brignoles (5940), Castellane, Colmars, Digne (3932), Draguignan (9804), Forcalquier (3036), Grasse (12,716), Hyères (10,142), Lorgues (5444), Moustiers, Seyne (6732), Sisteron (4429), Saint Maximin (3637), Saint Paul, Tarascon (10,967), Toulon (28,419). There was formerly another Viguerie, that of Guilleaumes, but it was broken up in 1760, on occasion of an exchange of territory between France and Sardinia. In Les Communautés des Terres adjacentes et Villes franches were Marseille (145,115), Arles (20,236), Salon (5987); Richebois, Les Baux, Notre-dame de la Mer, or Les Saintes-Maries, Aureille, Foutvielle or Fontvieille (2056), Aurons, St. Tropez (3736), Entrevaux, Le Mas, Mondragon, Grignan and its county, which last included the Communautés of Montségur, Chantemerle, Salles, Collonselles, Allan, and Réauville. Le Comté de Sault comprehended the Communautés of Sault, Aurel, Monioux, Sainte-Trinité, La Garde, and Ferrassières. The figures subjoined to the above names indicate the population of the respective communes in 1831. After the discontinuance of the States (who appear to have been appointed and to have acted only for Le Pays des Vigueries) the local taxation was adjusted by general assemblies, comprising thirty-six deputies from the Vigueries and principal Communautés, with the representatives of the clergy and provincial noblesse. The judicial divisions do not require to be mentioned. The ecclesiastical divisions consisted of seventeen dioceses, including those of Avignon, Carpentras, Vaison, and Cavaillon in Le Comtat Venaissin and Le Comtat d'Avignon. Provence is now divided into the departments of Basses Alpes, Var, and Bouches du Rhône; some portions are included in the department of Vaucluse.

The name of Provence is derived from the designation Provincia, given by the Romans here as elsewhere, to those countries and districts beyond the limits of Italy which they brought under their dominion, and from being at first a merely descriptive term, it has come to be appropriated as a proper name. In Cæsar's time the 'Provincia' of the Romans included not only the modern Provence, but the adjacent and more extensive districts of Dauphiné and Languedoc, and parts of Savoy and Switzerland; and it is in this more extensive application of the term that it is employed by Cæsar in his 'Commentaries. When his conquests and those of his successors had extended the Roman dominions, new provinces, as Lugdunensis or Celtica, Aquitania, and Belgica were formed; and the original 'Provincia' was distinguished as Narbonensis. At a later period Narbonensis was subdivided into the five smaller provinces of Narbonensis Prima, Narbonensis Secunda, Viennensis, Alpes Maritimæ, and Alpes Graiæ and Penninæ. The modern Provence includes portions of Narbonensis Secunda, Viennensis, and Alpes Maritimæ. In the overthrow of the Roman empire Provence was divided between the Visigoths, who held the coast, and Burgundians, who occupied the inland part, the Durance being the boundary. In 511 the Visigoths ceded their portion to Theodoric, the Ostrogothic king of Italy, and he wrested it from the Franks, by whom it had been seized. In A.D. 530, the Burgundian portion was conquered by the sons of Clovis; and in 534 the other part was ceded to them by Vitiges, one of the successors of Theodoric. The whole was included in the empire of Charlemagne.

On the division of the states of the emperor Lothaire (A.D. 855), Provence was included in and gave name to the kingdom of his youngest son Charles, on whose death (A.D. 863) his kingdom lost its separate existence. On the revival of the kingdom of Bourgogne by Boson (A.D. 879), Provence was included in his dominions, which are sometimes called the kingdom of Provence. This kingdom came by the cession of Hugues (who possessed the royal authority without the title of king) into the hands of Rodolph II., king of Transjurane Bourgogne, who united the whole into one extensive kingdom, under the title of the kingdom of Arles, Gaule Cisalpine, or Bourgogne Jurane. [Bourgogne.] It extended from the Jura to the Rhône and the Mediterranean. Upon the death of Rodolph III. (A.D. 1032), the kingdom of Arles was united to the German empire, of which Provence was long considered as a part.

Under the kings of Bourgogne, the greater part of Provence was governed by counts, who fixed their residence and took their title from Arles. The city of Marseille was under its viscounts, from whose superiority the citizens gradually emancipated themselves; and other neighbouring districts became the territories of feudal nobles. Gradually the counts of Arles rendered their county hereditary, and took the title of counts of Provence. The weakness of Rodolph III., the last king of Bourgogne, and the remoteness of the seat of government, after Provence was annexed to the empire, facilitated the aggrandizement of these nobles.

In the year 1112 or 1113, Raymond Bérenger I., count of Barcelona, in Spain, became, in right of his wife, count of Provence; but in 1125 he ceded to Alfonse-Jourdain, count of Toulouse, all that part of his territories which were north of the Durance, including Le Comtat and part of what was afterwards comprehended in Dauphiné. This ceded portion was known for a time as the Marquisate of Provence, in contradistinction to the part which remained to Raymond Bérenger, and which retained the designation of the County of Arles or Provence. The following century was distinguished by wars, occasioned by disputed succession, by the rivalry of the counts of Provence with those of Toulouse and others of the neighbouring nobles, or by other causes. But amidst these disorders the prosperity of the country seems to have advanced; and the cities of Aix, Arles, Avignon, Marseille, and Nice profited by the confusion to renounce all but nominal subjection to the counts, and to become practically municipal republics. All of them did not indeed retain their freedom; Arles returned under its former master, the count of Provence, though with restrictions on his authority, and Avignon was taken (A.D. 1226) by Louis VIII. of France, in his campaign against the Albigeois or Albigenses. Among the counts of Provence in this troubled period, Raymond Bérenger IV. (A.D. 1209-1245) was one of the most remarkable. He left four daughters, two of whom, Eléonore and Sancie, were married to Henry III. of England, and his brother Richard, earl of Cornwall and king of the Romans; and the other two, Marguerite and Beatrix, to St. Louis, king of France, and his brother Charles, count of Anjou and Maine. Beatrix, though the youngest, inherited the county of Provence, which thus passed into the Anjevin branch of the royal family of France.

It was under the counts of the house of Barcelona that Provence became the seat of that literature which has given the chief celebrity to its name and the chief interest to its history. Its comparative freedom after the age of Charlemagne from those foreign invasions which retarded in other parts the settlement of society and language, and its situation on the shores of the Mediterranean, which promoted commerce and opened a channel of communication with Constantinople and the Levant, and the generally wise administration of the counts who preceded Raymond Bérenger I., had contributed to bring the language, laws, and customs of the country into a comparatively settled state. The Provençal language gradually supplanted the Latin, which a succession of foreign admixtures had barbarised; and the new tongue, though not employed in deeds and contracts, was employed as the vehicle of reviving literature. [FRANCE; *Historical Sketch of the French Language and Literature*, vol. x., p. 432-3.] 'The succession of Raymond Bérenger to the sovereignty of Provence gave a new impulse to the national spirit, by the intermixture of the Catalans with the Provençals. Of the three branches of the Romanzo used by the Christians of Spain, the Catalan, the Castilian, and the Gallician or Portuguese, the first was almost exactly like the Provençal. . . The Catalans therefore perfectly understood the language of the Provençals, and by their meeting in the same court, each imparted refinement to the other. The Catalans had made considerable improvement, both by their wars and communications with the Moors of Spain, and by the activity of commerce at Barcelona. This city enjoyed the amplest privileges; the citizens appreciated their liberty, and caused it to be respected by their princes; while the wealth which they had acquired, by increasing the productiveness of the taxes, allowed the display of a magnificence at the court of their counts which was unknown to other princes. Raymond Bérenger and his successors brought with them into Provence the spirit of liberty and that of chivalry, a taste for elegance and for the arts, and the scientific knowledge of the Arabs. From this combination of noble sentiments sprang the poetry which in Provence and in the whole of the south of Europe burst out all at once, as if an electric spark had, in the midst of the thickest darkness, kindled in every part at the same time the brightest flames.' (Sismondi, *La Littérature du Midi de l'Europe.*)

The literature of Provence differed materially from the contemporary productions of northern France. These partook of the epic, the Provençal of the lyric character. The theme of the troubadours, or Provençal poets, was love; and they exhibit the passion in their songs with a purity, delicacy, and tenderness, derived probably from the Arabs, with whom their Catalan connection brought them into contact. Yet the actual relaxation of manners among the nobility in the south of France was at this time very great. 'It might be said that men lived only for gallantry; the ladies, who scarcely appeared in public, except when married, prided themselves on the reputation which their charms derived from their lovers; they delighted in the praises of their troubadours; they took no offence at the diffusion of the gallant and often licentious poetry of which they were the theme; they themselves cultivated 'the gay science,' as poetry was called, and expressed their own sentiments in their turn, in tender and impassioned verses; they had instituted 'courts of love,' in which questions of gallantry were gravely discussed, and determined by their suffrages; in a word, they had brought the whole of the south of France into a state of carnival, which forms a singular contrast to the ideas of reserve, virtue, and modesty which we ascribe to the good old times.' (Sismondi, *Littérature, &c.*) It was from the Arabs, through the medium of the Provençal troubadours, that rhyme was introduced into the poetry of modern Europe, according to Sismondi; but others think that it is not clear that rhyme was not used in Europe before the conquest of Spain by the Arabs.

The Provençal language spread, with the poetry of the troubadours, into the various courts of Europe; several of the princes of the West, our own Richard Cœur-de-Lion among others, wrote in it, and it became the most copious and flexible of any of the languages of Western Europe of that period. It was the exclusive vehicle of amorous, warlike, political, and satirical poetry; and the crusades in particular furnished a variety of incidents for those who cultivated it.

The acquisition of Provence by Charles I. of Anjou in right of his wife Beatrix (A.D. 1246) augmented its political importance. Charles had to struggle with the independent spirit of the large towns. Avignon and Arles, which had rejected his authority while he was in Egypt with his brother St. Louis, were obliged to submit, but upon terms which secured to them valuable privileges. Marseille was also reduced, and suffered considerable loss of freedom by the subjection. The death of Beatrix, and the assumption of the sovereignty of Provence by Charles in his own right, led to an opposition to his title by the queens of France and England, sisters of the deceased countess: but as the two kings did not undertake the matter, the opposition was fruitless, and Charles transmitted Provence (A.D. 1285) to his son Charles II., who was then a prisoner in the hands of the king of Aragon. Charles resigned Anjou and Maine to his cousin Charles of Valois, and contested the possession of Naples and Sicily, which his father Charles I. had conquered with the king of Aragon. He also united Piedmont to Provence (A.D. 1306), and died (A.D. 1309) in the neighbourhood of Naples. His son and successor Robert took an active part in the struggle of the Guelphs and Ghibelines in Lombardy. These Italian wars of the Anjevin princes materially injured Provence by draining it of its population; but in other respects Robert appears to have governed well, and his death was regretted by his subjects (A.D. 1343). He was succeeded by his grand-daughter Jéanne or Joan [JOAN I.], who granted or sold to the pope the city and lordship of Avignon. Provence was, during her reign, claimed by John of Gaunt, son of Edward III. of England, in right of Eléonore, wife of Henry III. of England, from whom he was descended; and by Louis, duke of Anjou, governor of Languedoc for his brother Charles V. of France, who founded his claim on the cession of the kingdom of Arles made to him by the emperor Charles IV. Provence was invaded by Louis's forces under Bertrand Duguesclin, but without success; and John of Gaunt was obliged to submit his claims to the decision of the pope. On the death of Jeanne, who was taken at Naples, and put to death by Charles of Durazzo (A.D. 1382), Provence came to Louis, duke of Anjou, to whom the deceased countess had bequeathed it. He ceded Piedmont to Amadeus, count of Savoy, and died (A.D. 1384) in the kingdom of Naples, of which he had tried in vain to secure possession. Louis II. succeeded his father, and renewed the attempt to gain possession of Naples, but with like ill success. On his death (A.D. 1417) Louis III. succeeded, and pursued his hereditary claim to Naples, which brought him into a struggle with Alfonso V., king of Aragon [ALFONSO V.], who took Marseille (A.D. 1423). [MARSEILLE.] On the death of Louis (A.D. 1434), his brother René, surnamed Le Bon (the Good), succeeded. He united under his sway the duchy of Anjou and the county of Provence, and was competitor of Antoine de Vandemont for the duchy of Lorraine [LORRAINE], which he succeeded in acquiring. He also attempted to acquire Naples, but met with the same ill success which had attended the efforts of his predecessors. The earlier part of his reign was actively employed in warlike enterprises; but the latter part he quietly spent in Provence, cultivating the sciences and the fine arts, and living in the midst of his subjects 'like a father amid his family.' He had resigned Lorraine to his son, to whose charge he also gave up the prosecution of the war in Naples. René le Bon died at Aix, A.D. 1480. Charles, Count of Maine, his nephew and successor, had to defend Provence against the invasion of a competitor, René II. of Lorraine, grandson by his mother of René le Bon; by the support of Louis XI. of France, he succeeded in repelling him, and dying soon after (A.D. 1481), bequeathed his dominions to Louis. René of Lorraine still asserted his claim, but was unable to maintain it; and Provence was finally annexed to the crown of France by Charles VIII., the successor of Louis XI. (*L'Art de vérifier les Dates*; Simonde de Sismondi, *Littérature du Midi de l'Europe*.)

PROVERB (from the Latin *proverbium*, i.e. *pro-verbum*, in which respect the form of the word bears analogy to *præludium*, and other words of the kind), a by-word, which meaning is also conveyed by *adagium*, 'adage,' and the Greek *paroemia* (*παροιμία*). Of the many definitions which have been given of a proverb, the best appears to be the following by Erasmus: 'Parœmia est celebre dictum scitâ quâpiam novitate insigne;' 'A proverb is a well-known saying, remarkable for some elegant novelty;' or, as Dykes translates it, 'A proverb is a celebrated saying, famous for its remarkable elegancy, wit, and novelty.' Synesius, a Christian writer of the early part of the fifth century, quotes from a work of Aristotle, now lost, a description of a proverb to this effect: 'A proverb is a remnant of the antient philosophy preserved amidst very many destructions on account of its brevity and fitness for use.' 'Proverbs,' says Daniel Heinsius (*Dedication* prefixed to Elzivir edition of Apostolius), 'are nothing else but abridged remains of the wisdom which is not comprehended in books, and is conveyed down from hand to hand like an heir-loom.' To collect and explain such portions of wisdom has engaged the attention of some of the most learned men. Aristotle, Theophrastus, Chrysippus, and others, according to Laertius, made collections of proverbs. With the works of Plutarch is printed (*Opera Moralia*, vol. v., ed. Wyttenbach) a collection of 131 proverbs, with explanations; and, though this collection has not been uniformly acknowledged as Plutarch's, there is good reason to believe it to be his genuine work. Zenobius [illegible]dotus, a Sophist who lived at the beginning of the second century, made an epitome of the proverbs of two older writers, Tarraeus and Didymus, in number 552. Diogenianus lived about the same time as Zenobius, and made a collection of proverbs, amounting to 775. These two collections, together with 1400 proverbs out of Suidas, and an appendix of 353 from the Vatican Library, and a selection of proverbs in metre, were well edited by Andrew Schott, 4to., Antwerp, 1612. Michael Apostolius of Byzantium, who lived in the middle of the fifteenth century, collected 2027 antient proverbs, of which he wrote explanations. The best edition is that of the Elzivirs, 4to., Lugd. Batav., 1653. The adages of Erasmus, in number 4151, are too well known to require any description. They are presented in their most useful form in the Epitome of them published by the Elzivirs, 12mo., Amst., 1663. Many other modern writers have published collections of proverbs from various languages. The name of our own countryman, John Ray, is familiar to all the lovers of natural history. In 1672 he published his collection of proverbs, which has been often reprinted. Modern languages contain a great number of proverbs, some of which have been transmitted from the remotest ages, and are the common property of all civilised nations; others are peculiar to individual nations, and are capable of being traced to a modern origin. The Spanish language is particularly rich in proverbs, many of which have obviously had their origin in national peculiarities of character and usage. There is a small and valuable collection of English proverbs with lengthened explanations, and an ingenious preface, by Oswald Dykes, 8vo., Lond., 1708.

According to the definition given by Erasmus, two things are especially required to constitute a proverb; 1, that it be recognised by all classes of men as common property; 2, that it be marked by a peculiar turn of expression, so as to be at once distinguished from ordinary speech. The former quality belongs to a proverb, inasmuch as it derives its origin, real or supposed, from oracles, philosophers, poets, orators, and historians; from the manners and customs common to all men; from the habits of the brute creation; and from the general operation of the laws of nature. The latter quality is essential, inasmuch as quaintness, or elegance, or even obscurity of expression, will invest what is old with the appearance of novelty, and make the sentiment striking, and secure such attention as the language of ordinary intercourse never could.

Proverbs generally convey moral instruction, and that in the most direct and effectual way; but moral instruction is not essential to the nature of a proverb. Such proverbs as 'Old birds are not caught with chaff;' 'Birds of a feather flock together;' 'Tis an ill wind that blows nobody good,' 'Money makes the mare to go;' do not, directly at least, teach any moral lesson. Such proverbs as 'Honesty is the best policy;' 'Be just before you are generous;' 'Take care of number one;' and others of the kind, as 'Every man has his price,' seem adapted to make men satisfied with a very low standard of morality. But these are abuses of proverbial teaching, and are of course to be avoided, while due regard is paid to its legitimate use. Good proverbs judiciously employed will 'never fail of exciting by their quaintness, of delighting by their shortness, of persuading by their authority.' (Dykes's *Preface*.)

A full and excellent account of antient and modern collectors of proverbs is given in the third volume of the 'Bibliotheca Græca' of Fabricius. On the general character and use of proverbs, the reader will be gratified by consulting the works of Ray and Dykes already mentioned.

PROVERBS OF SOLOMON, one of the canonical books of the Old Testament. The Hebrew מָשָׁל, translated *proverb*, denotes a similitude, from מָשַׁל, *to liken, compare*, and is rendered in the Septuagint by *παροιμία*, but oftener by *παραβολή*. In reference to this book, the use of the Hebrew word is the same as that of the English *proverb*; and Erasmus's definition, as given in the preceding article, will apply to the Proverbs of Solomon.

This book has always been ascribed to Solomon, though he was not the author of all its contents. The thirtieth chapter is entitled 'The words of Agur the son of Jakeh,' and the thirty-first chapter, 'The words of King Lemuel;' and it is not improbable that many of the proverbs in the preceding part of the book were in current use long before the time of Solomon. The portion from the tenth chapter to the end of the twenty-fourth comprises what may more strictly be called the 'Proverbs of Solomon.' The first nine chapters form a kind of introduction, and the remaining chapters after the twenty-fourth may be regarded as an appendix to the whole.

The Book of Proverbs is classed by Bishop Lowth among the didactic poems of the Hebrews (*De Sacra Poesi Hebr.*, *Prœl.* xxiv.). The attentive reader of the original will discover the utmost exactness in the choice and arrangement of words, and will be able with ease to carry out the principles laid down by Lowth relating to the structure of Hebrew metre.

The Proverbs of Solomon are all pre-eminently adapted to teach the lessons of prudence, morality, and religion. They are a precious treasury, from which men may be supplied with the best rules for the conduct of life. They may be compared to so many jewels put together without any visible order or connection, but each shining with its own peculiar beauty, a beauty which is increased rather than obscured by this apparently accidental association of one with another. In a word, to use language furnished by the book itself, 'they are like apples of gold in pictures of silver' (xxv. 11). 'Let a man,' says Bishop Patrick, 'but consent to one thing, which this book desires, to make these precepts familiar to his mind, saying unto wisdom, thou art my sister, and calling understanding his kinswoman, and he will not fail to be happy.' (Patrick *On the Proverbs of Solomon*; Horne's *Introduction*.)

PROVIDENCE is the superintending care with which God watches over his whole creation, and especially over the human race. It has been generally held, as a direct consequence of the existence of a God who has created all things, that he must also uphold by his constant care everything which he has created. This doctrine however has been denied by the antient Epicureans and the modern Theists, who, while admitting that God created the universe, and impressed upon it the laws by which it is governed, have contended, that having done this, he has left these laws to work out their own results without his further interference. The arguments for a superintending providence are derived from the order of the material universe, which we find to be governed by ever-active principles, of which no other explanation can be given than that they are the results of the power of God in continued exercise; from the events which are recorded in history, and which are daily occurring, such as the punishment of guilty nations and individuals, the exaltation of the virtuous, the adaptation of great men to the exigencies of their times, not to mention other circumstances in the history of individuals, which might be considered of a more doubtful character; and lastly, from the unequivocal statements of Scripture. The whole sacred narrative is evidently intended to show how God's providence wrought for the accomplishment of his own designs. Moreover, individuals are mentioned, such as Pharaoh, Nebuchadnezzar, and Cyrus, whom God raised up expressly in order to use them as instruments to effect certain objects. Two books of the Old Testament, those of Job and Esther (we might perhaps add those of Ruth, Jonah, and even others), appear to have been written for the very purpose of confirming our faith in the providence of God; and numerous passages might be quoted which teach the care of God over the whole universe (*Col.* i. 17; *Heb.* i. 3; *Rev.* iv. 11), over all men, whether good or wicked (*Job.* xxv. 3; *Matt.* v. 45; *Acts* xvii. 28; *James*, i. 17), and especially over his own people (*Matt.* v. 25-34, &c.).

The providence of God has been divided by theologians into *immediate*, or that which he exerts without the intervention of second causes, and *mediate*, where ordinary means are employed; into *ordinary*, which relates to occurrences in the common course of nature, and *extraordinary*, where that course is departed from, as in the case of miracles; into *common*, of which the whole world is the object, and *special*, which regards the church; and into universal, which describes the care of God for his whole creation, and *particular*, which is exercised for the benefits of individuals.

PROVIDENCE. [RHODE ISLAND.]

PROVIDENCE, NEW. [BAHAMAS.]

PROVINCE OF POINT WELLESLEY. [PENANG.]

PROVI'NCIA may be defined generally to be a conquered country, beyond the limits of Italy, which was subject to the Roman state. In contemplating the history of Rome, the most instructive part of it, next to a study of the internal organization of the state, is the system of provincial government by which the language and laws of Rome were established on a foreign soil. The effects of this system are permanently embodied in the political system of every European state. In order to exhibit a complete view of Roman provincial government it would be necessary to write the history of Rome, but the following outline may be useful.

The geographical sense of the word Provincia was not the original meaning; originally the term expressed the Imperium, which was granted to a consul or prætor beyond the limits of the city. The precise meaning of the word is not certain, and the common etymology is perhaps doubtful (pro, vinco*); its primary sense however certainly was a power as above explained. In the time of Cicero provincia had undoubtedly obtained the meaning given at the head of this article; and in the latter part of the Republic the Roman state consisted of two distinctly organised parts, Italy and the Provinces. This distinction, though with considerable modifications, continued under the Empire.

With the extension of the Roman conquests beyond Italy, commenced the system of provincial governments. The oldest provinces were Sicily (B.C. 243) and Sardinia (B.C. 237). Upon the conquest of a country, the commander of the army either gave the conquered country a general organization, subject to the approval of the senate; or the country was organized according to the instructions of the senate, by the commander and a body of commissioners chosen from the senate, and appointed by it. This original organization often made very important changes in the existing political forms, but still the conquered people retained their national existence, and were not in all senses incorporated into the Roman state. Originally prætors were appointed to govern the provinces [PRÆTOR]; but subsequently the prætors received a province after the expiration of their year of office at Rome, and were then called proprætores; and towards the close of the republic the consuls in like manner received provinces, which were hence called consulares, and they were styled proconsules. The division of the provinces was made by lot, and sometimes by agreement among the persons entitled to hold them. By a law of C. Gracchus (Sempronia lex), the provinces of the consuls were annually determined before the election of the consuls, for the purpose of preventing all disputes.

By a senatus consultum of the year 55 B.C., it was enacted that prætors and proconsuls should not have the government of a province till five years after the expiration of their prætorship or consulship. The term for which a province was originally held was one year; but the time was often enlarged. The authority of the governor of a province commenced as soon as he left Rome. His functions in the province were both military and civil; he possessed the Imperium, but he was not called a magistratus. In the later Roman writers the common name for governor is præses (Gaius, i. 6), and sometimes the term proconsul seems to be used generally for the governor of a province. The governor was assisted in the discharge of his duties by a quæstor, who looked after the revenue; and by legati, who assisted in the administration, and were generally appointed by the senate, but sometimes by the governor with the permission of the senate. He had also a numerous train of friends and companions, sometimes called contubernales; and also a regular body of clerks, interpreters, and other servants, who formed a prætorian cohort, a name which was also given, and with more propriety, to the soldiers who formed the governor's body-guard. On a new governor arriving in his province, the former governor was required to leave within thirty days.

The province was treated as a conquered country, though the towns retained somewhat of their municipal freedom, but the constitution of many of them at least was refashioned upon the model of Rome, though in this respect there were probably considerable varieties. Under the emperors the political organization of the whole empire became more uniform. The towns had the management of their revenue, and the right of coining; but only towns of the highest class could coin silver. They had a senate like those in the Italian towns, but no magistrates with corresponding powers. The religion of the people was not interfered with.

In some cases part of the land of conquered foreign countries was seized by the Roman state and let by the censors; or the forfeited land was restored, subject to the payment of a rent. All provincial land differed in some essential particulars from Italian land: it could not be the subject of quiritarian ownership, that is, it had not the privileges of Italian land, and it was capable of being transferred without the forms required in the case of Italian land. There was private property in provincial lands, but the ultimate ownership, in the Imperial period at least, was considered to be in the Cæsar or in the Roman state (populus Romanus). (Gaius, ii. 7.) All provincial lands paid taxes (vectigalia et tributa). But certain provincial towns received as a special favour the Jus Italicum, the legal effect of which was to give the land included within the limits of such town all the qualities of Italian land, and consequently freedom from taxation. Such towns also received, as a part of the Jus Italicum, a free constitution like that of the Italian towns, and with it the various magistrates, decemviri, quinquennales (censors), ædiles; and also jurisdictio, or the power of holding courts of justice. Various towns which enjoyed this privilege are enumerated, in Spain, Illyria, Gaul, and elsewhere. The origin of this privilege is assigned by some writers to the Imperial period; but perhaps it commenced earlier. In all the provinces the regular jurisdiction was in the hands of the Roman governor, who exercised it by himself and his quæstor and legati; and for this purpose he made circuits in his province. In reference to this part of his duties, the governor is sometimes called Judex Ordinarius under the later emperors. These circuits, sometimes called conventus, formed what we may call the divisions of a province for judicial purposes. Thus Pliny (iii. 3) says that Hispania Citerior was divided into seven conventus, which he enumerates. The towns which had the Jus Italicum were not comprised in the conventus; they had their magistrates, in the Italian sense of the term, who had jurisdictio; but there was an appeal to the governor. At these conventus there were present a great number of Roman citizens, who were engaged in commerce in the province, or who were publicani, farmers of the revenues. These conventus, which are frequently mentioned by the Roman writers, were not accidental assemblages of persons, but meetings at stated times and places appointed by the governor, and principally for the purpose of judicial decision on matters in dispute, both between Roman citizens, and Roman citizens and the provincials. The judices were chosen, after the Roman fashion, from the persons who attended the conventus, or circuit courts. It appears that the fundamental laws of a province were not interfered with, for, as we have seen, the soil retained its former legal character, and was not invested with that of Italic soil, and the personal status or condition of Roman citizens was not communicated to the provincials merely as such. Some of the provinces, as Sicily, obtained the Latinitas [LATINUM JUS] from Julius Cæsar, and the Civitas, or complete Roman citizenship, was given to the Sicilians after his death (Cic., *Ad Att.*, xiv. 12); but this was not the general rule. By means of the edict, which the prætor published on entering upon his duties, and which was often framed upon the prætorian edict at Rome [PRÆTOR], many important changes must have been gradually introduced into the legal system of the provinces, and particularly with reference to matters of contract and forms of procedure, in which there could be no ground for the same distinction that was maintained between provincial and Italic land, and which necessarily influenced the rights of landholders and the forms of action. Special enactments (leges) were also sometimes made at Rome with reference to provincial affairs. The prætor had complete jurisdiction in criminal as well as civil matters, and both over provincials and Roman citizens; but a Roman citizen could appeal to Rome in a criminal matter.

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* *Provintia* may be the true orthography.

A province consisted of a variety of parts. Some towns included in it had from the commencement an alliance with Rome, and were in all respects free. Others, which had been subdued, were declared free, and were not under the immediate jurisdiction of the prætor. The provinces also contained numerous colonies, and both colonies of Roman citizens and colonies of the class called Latinæ. [LATINUM JUS.] Thus towards the close of the republican period a province contained, besides those parts of it which were subject to the complete jurisdiction of the governor, allied towns, free towns, Roman colonies, and Latin colonies. According to this view, the provincia properly comprised those parts and towns which were subject to taxation and to the prætor's immediate jurisdiction. Some writers assert that the Roman and Latin colonies which were sent from Italy into the provinces were in all respects like such colonies in Italy, and that these colonies had quiritarian ownership of the soil, and consequently freedom from taxes. But there is some difficulty about this part of the subject. The privileges called Latinitas, or Latium, were often given to particular towns, one effect of which was to release them from the immediate jurisdiction at least of the Roman governor, and to give them a jurisdictio, or power of holding courts: citizens who filled certain offices (magistratus in such towns), thereby obtained the Roman citizenship. (Strabo, p. 186, speaking of Nîmes. See our article, p. 234.)

The taxes which were raised in the provinces varied in the different countries, according to the products of the provinces, and probably also according to the system of taxation which the Romans found established; for they seem in their administration to have avoided the error of changing more than was necessary. The taxes generally consisted in a capitation tax and a property tax: the latter was sometimes paid in money and sometimes in kind. The state did not collect the taxes, but they were sold or farmed: thus, after the Sempronia lex, those of the provinces of Asia were sold by the censors at Rome, and those of Sicily, with some exceptions, were sold in the respective districts of the country, according to a practice established by Hiero. There was also money paid for the use of the open pasture-lands, which the Roman state appropriated to itself. The tolls and port duties, as well as the pasture-land tax (scriptura) were farmed by the publicani. [PUBLICANI.] Besides these and other regular sources of revenue, the province was subjected to occasional demands of an additional tenth, and to many exactions, some of which had a kind of legalised form, and others were merely gifts made to satisfy the demands of the governor, or to secure his favour.

The governor had to give an account of his administration from his own books and those of his quæstor. Originally he gave in this account at Rome; but after the Julian law (B.C. 61), he was required to deposit two copies in the two principal towns of his province, and to send one to the Ærarium at Rome. If the province had ground of complaint against him for mal-administration (repetundæ, peculatus), which was no uncommon thing, application was made to the Roman senate; and the great Romans, who were the patrons and friends of the cities which made the complaint, were also applied to for their aid and interest. If he had betrayed the interests of the Roman state, he was guilty of the offence of majestas. A regular mode of inquiry and trial (quæstio) were adopted for such occasions. Yet little was done without bribing the powerful men at Rome; and the chance of redress against a governor who had even grossly misconducted himself was very small: it was more frequently obtained through the influence of the powerful Romans, stimulated by motives of private hostility to the accused, than through the justice of the case.

With Augustus commenced a new period. He took under his own care the more important provinces, and those which required a large military force; the rest he left to the care of the senate and the Roman people. This arrangement continued, with some modifications, to the third century. Of the provinces of the senate, two were yearly given to consular men, and the rest to those who had been prætors: these governors were all called proconsuls, and they were assisted by legates. They had the jurisdictio both of the prætor urbanus and peregrinus. Quæstors were also sent with them to their provinces: the quæstors had the same jurisdictio that the ædiles had at Rome. It seems however that the power of the proconsuls in their provinces was considerably diminished. The emperor considered himself as the proconsul of his own provinces; and he governed them, though residing in Rome, by his representatives called legati Cæsaris, who had prætorian power. They were selected from those who had held the office of prætor and consul, or were senators of inferior rank. The Imperial governor of Egypt was called præfectus, and he was always an Eques. They held their office so long as the emperor pleased, and received all their powers directly from him. These governors of the emperor's provinces were called præsides and correctores in the later periods, though the name præses was applied under the emperors to a governor either of a senatorial or an Imperial province. They had also legati under them; but in the place of quæstors there was a procurator Cæsaris, who was an Eques or a freedman of the Cæsar; he looked after the taxes and other dues of the emperor, paid the troops, and attended generally to the business of the fiscus. After the time of Claudius, the procurator had jurisdiction in matters that concerned the fiscus. There were also procuratores Cæsaris appointed by the emperor in the senatorian provinces, who collected certain dues, even in those provinces, for the fiscus, independent of what was the due of the Ærarium, or public treasury. Sometimes a small province, or a part of a larger one, was governed by a procurator Cæsaris, with the full power of a præses; this was the case with Judæa, which was a part of Syria, and governed by a procurator who was under the præses of Syria. The general constitution of the provinces remained the same, though, as before observed, a greater uniformity in administration was gradually introduced, and from the time of Hadrian the Imperial rescripts and the writings of the Roman jurists contributed to form a body of common law for the whole empire. The taxes continued as before, and were partly paid in money, and partly in kind; but the object of the Romans was always to have them paid in money. The basis of the taxation was a general census of persons and property, which Augustus introduced, and which was taken from time to time. Certain taxes, as tolls and duties, were let, as before, to the publicani. The towns, at least under the early emperors, seem to have retained their privileges; though some modifications were very early introduced; for instance, Augustus indirectly deprived the citizens of the colonies of their suffrage at Rome, a measure which seems to have led the way to other changes. Numerous colonies, chiefly if not exclusively of the class called military, were also established by the emperors in the provinces; and it is to this period that some writers refer the gift of the Jus Italicum to provincial cities.

The inhabitants of the provinces were now divided into three classes as to political rights, Roman citizens, Latini, and Peregrini. The Roman citizens were either Italians resident in the provinces; or members of Municipia and colonies which had the Roman citizenship; or those who had individually obtained this right. The two latter classes had all the privileges of Italians, except with some restrictions as to attaining the senatorian dignity: but many of them obtained the rank of Equites. The Latini had not the connubium only and the commercium, but they could obtain the civitas in several ways. The Peregrini had neither the connubium nor commercium; in fact, they had none of those rights which characterised a Roman citizen; but yet they served in the army. By a constitution of Antoninus Caracalla (A.D. 211-17), the citizenship was given to all persons within the Roman empire, and accordingly the distinction of Civis, Latini, and Peregrini ceased, and the two latter classes henceforward only existed among manumitted slaves.

The administration of the provinces gradually came more under the power of the emperor, and particularly as to matters which required a legal decision. The governors not only received general instructions from the emperor, but they made special application to him in cases of difficulty. The constitution of Caracalla must have had the immediate effect of extending the Roman law, for in making all persons Roman citizens, it established all the relations of personal status that existed at Rome; and it seems that a province became in nearly every respect assimilated to Italy, with perhaps the exception as to the soil, when the special privilege was not given to it. Indeed Italy itself was assimilated to the form of a province by Hadrian, who divided it, with the exception of a district that was immediately appropriated to the praetor urbanus, into four divisions, which he placed under the care of consulares. Under M. Aurelius, the consulares were replaced by juridici, a word which indicates their function of dispensing justice. The privileges of the towns, as to jurisdiction, were gradually encroached upon by the Imperial power and those to whom it was deputed, a change the commencement of which is traced by Savigny to the time when Cisalpine Gaul ceased to be a province and was incorporated with Italy. In the provinces justice was administered generally by the praeses and his legati, though not always in the first instance, and the privileges of the free towns were in course of time impaired. The praeses and his legati had full jurisdiction; there was an appeal from the legati to the praeses, and from him to the emperor; and it was not uncommon for the proconsul to refer a matter of law to the emperor even in the first instance. The praeses had complete jurisdiction in criminal matters; yet he could not pronounce sentence of deportation. He had also ample powers both civil and military for maintaining tranquillity in his province, and there were soldiers stationed in all the provinces in permanent camps, many of which remain to the present day, and others were the origin of existing towns.

The condition of the provinces under the Christian emperors would require a separate and lengthened notice.

This general and necessarily very incomplete view may be completed by those who can refer to Savigny's *Geschichte des Römischen Rechts im Mittelalter*, vol. i.; to Walter's *Geschichte des Römischen Rechts*, &c., Bonn, 1840; where abundant references to original authorities are given. The statements in Adam's *Roman Antiquities* are generally correct. Incidental information will also be found in the following essays:—'Das Ackergesetz des Sp. Thorius,' *Zeitschrift*, x.; 'Ueber den Inhalt der Lex Rubria de Gallia Cisalpina,' *Ibid.*, x.; 'Ueber das Jus Italicum,' *Ibid.*, vol. v.)

The enumeration of the provinces is given under ROME.

PROVINCIALISM. The difference between the languages of a family and the dialects of a language is only a difference of degree. For example, the Sanscrit, Persian, Teutonic, Greek and Latin, Slavonic, and Celtic, are languages of the Indo-Teutonic family [LANGUAGE, vol. xiii., p. 309]; and the Doric, Ionic, and Æolic are dialects of the Greek language. Although the dialects of a language may present considerable differences both in the roots and forms of their words, the differences are less considerable than those which obtain between languages of the same family. Thus a historian tracing the origin of the Romance languages might doubt whether he ought to consider them as altered dialects of the Latin language, or as cognate languages of the same family. If the Italian, Spanish, and French languages were considered as modern Latin dialects, their various dialects (such as the Sicilian, Venetian, Milanese, Walloon, Valentian, &c.) would be regarded as mere varieties, analogous to the varieties of the Doric dialect as spoken by the different states of the Doric race. (Müller's *Dorians*, app. v.)

Every language which is spoken by a large population over a wide extent of country, contains several dialects. The number and variety of these is in some cases very great; and considering the importance of this fact as bearing on the origin and history of languages, it has not been sufficiently observed by philologists.

The cause of a want of attention to the multiplicity of dialects in a language is to be found in the ascendency which one dialect of a language always acquires over the others, and the obscurity and neglect to which the latter are consequently consigned. Whenever a country reaches a sufficient height of civilization to admire and produce literary works, some one of the various dialects of its language is selected by the poets and other native writers, and is cultivated by them. In general, this choice is determined not by any quality of the dialect itself, such as its superior harmony or energy, but by some external circumstance, such as its prevalence near the birth-place or home of the writer, or near the king's court and seat of the government. The influence of the latter circumstance is illustrated by the following remarks of Dr. Jamieson, in his preface to his dictionary of the Scottish language, respecting the cause of the decline of that language:—'The union of the crowns (he says), although an event highly honourable to Scotland, soon had an unfavourable influence on the antient language of the country. She still indeed retained her national independence; but the removal of the court seems to have been viewed as an argument for closer approximation, in language, to those who lived within its verge. From this time forward, as living authors in general avoided the peculiarities of their native tongue, typographers seem to have reckoned it necessary to alter the diction even of the venerable dead. In thus accommodating our antient national works to the growing servility of their times, they have in many instances totally lost the sense of the original writers. In this manner even the classical writings of our ancestors have been gradually neglected.' When a dialect, by any of the means above described, has been distinguished from and raised above the others, it is adopted for all the native literary compositions, both in poetry and in prose. Hence it is still further cultivated, and is moreover thereby rendered more susceptible of ulterior cultivation and refinement. It becomes the general language of the government, of education, of literature, and of polished society; new words are introduced into it from other languages, antient or modern; and it is learned by foreigners.

The rise and progress of one dialect, according to the general description just given, may be observed to have taken place in every civilised country. In *Greece*, on account of the multiplicity of independent states into which the nation was divided, each dialect of the language received a separate cultivation. The early historians and philosophers wrote in the Ionic dialect, and lyric poetry was composed in the Doric and Æolic dialects. But after the Persian war, and the great predominance of the Athenians, both in political power and in literature, the Attic dialect obtained the ascendant in Greece and became the common literary language. (Müller's *History of Greek Literature*, c. 20, § 1, 2.) In like manner, the Tuscan dialect, chiefly on account of the pre-eminence of the Tuscan writers, became the literary language of *Italy*, and threw into the shade the Sicilian dialect, in which the first essays of Italian poetry were made. But notwithstanding the predominance of the literary Tuscan in Italy, both as the literary language and as a means of communication between inhabitants of different parts of Italy, yet every Italian city or territory has its own dialect, which is habitually spoken, not only by the lower and middle classes, but also by the upper classes when persons from other parts of Italy or strangers are not present. [ITALY, vol. xiii., p. 62, 63.] In *France*, the dialect of the *langue d'oil*, spoken in and about the seat of government, has not only thrown into the shade the other dialects of that language (such as the Walloon, Picard, Norman, &c.), spoken in the northern portion of the kingdom, and reduced them to the condition of mere patois, but it has also superseded the *langue d'oc*, the language of the south, which had been raised to considerable literary importance by the poems of the Troubadours. [FRANCE, vol. x., p. 432.] The Castilian dialect has obtained a similar ascendency in *Spain* through the influence of the Castilian writers; and the high German of Saxony has become the literary language of *Germany* mainly through the influence of Luther's translation of the Bible; although the Suabian dialect received a literary cultivation in the lays of the Minnesingers before any other of the German dialects. [GERMANY, vol. xi., p. 193.] The classical *English* is mainly formed upon the dialect spoken in Middlesex, Surrey, Kent, and the other counties in the neighbourhood of London. Its forms differ materially from those of the dialects spoken in the more distant counties, as Devonshire, Somersetshire, Cheshire, Lancashire, and Yorkshire; and still more from those of the dialect of the English which is spoken in the lowlands of Scotland, and in the border counties of England. The latter dialect has received considerable literary cultivation not only from early writers, such as Buchanan, Barbour, and others, but also from Burns, Walter Scott, and their imitators, who have used it with great skill and success for ballad poetry and tales of fiction.

A peculiar dialect of the English has been formed in the New England States of the American Union, a specimen of which may be seen in the humorous work by Mr. Haliburton, entitled 'The Clockmaker.' The American dialect of the English contains a few words which are peculiar to the country (such as *caucus, mocassin, pappoose, squaw*); but most of the American expressions have been borrowed from English provincialisms, and are still current in different parts of England (as, *I reckon* and *I guess, roile, snag, spry*, &c.). See Pickering's *American Vocabulary*, Boston, 1816.

By a provincial word is meant a word which is not received in the literary language of the time, but which is current among the inhabitants of some district; and provincial words may be divided into the following classes:—

1. Words formerly current in the literary dialect of the language, but which have ceased to be so, and are current only as provincialisms. For example, the word *cantle*, meaning a piece or fragment, and *shard*, meaning cow-dung, are used provincially in parts of England, though obsolete in the literary language. They were however literary words in the time of Shakspere.

> 'See how this river comes me cranking in,
> And cuts me from the best of all my land,
> A huge half-moon, a monstrous *cantle* out.'
> 1 *Hen. IV.*, act iii., sc. 1.
>
> 'Ere to black Hecate's summons
> The *shard-born* beetle, with his drowsy hums,
> Hath rung night's yawning peal, there shall be done
> A deed of dreadful note'
> *Macbeth*, act iii., sc. 2.

(See *Craven Glossary* in v. 'shard.')

So *clomb*, the preterit of *climb*, occurs in Chaucer and other old writers, but is now only a provincialism.

Sometimes an antient classical word, though current provincially in ordinary discourse, is used as a literary word only in poetry or as a technical term. Thus the old words *craven* for coward, and *dank* for damp, which are still used familiarly in the provincial language of some districts, could only be employed as literary words in poetry or in poetical prose; and the old word *soller*, meaning an upper floor, which is current as a provincialism in many parts of the country, is only recognised by the literary language as a legal term, being thus used in the general words of a conveyance ('cellars, sollers,' &c.).

2. Words which are not known to have ever been received in the literary language of the country. Many words of this class will occur to any person who consults a provincial glossary of any language. In some cases the word differs widely from any word which occurs either in the modern literary language or in old writers; more frequently however the difference consists mainly in the form. The Scotch dialect presents obvious examples of all these varieties. Sometimes a provincial word is not a dialectical variety of form, but is a corruption arising from ignorance, as *atomy* for *anatomy*, *rusty* for *restive*.

From the manner in which provincial dialects are preserved, it is natural that many archaisms of language should remain current in them after they have been lost in the literary language. Thus Buttmann, in his 'Lexilogus,' explaining the word ἀκοστεῖν, which occurs in Homer, cites statements of grammarians that ἀκοστή meant barley, among the Cyprians and Thessalians, and proceeds to remark as follows:—'That Homer never used the word ἀκοστή itself, is no objection to this derivation, any more than that it was borrowed from the Cyprians or Thessalians. Heyne has judiciously observed, that old words which disappeared from common use were still visible much later in certain dialects. Such idioms were noted while Greek was still a living language, in part for the very purpose of explaining Homer and other antient writers; and thus such words as this were introduced into the glossaries. Ἀκοστή therefore was a genuine old name for barley, and though in Homer's time and in his particular country it might not have been the common name for it, still an expression taken from this word might very well have been in use in the language of common life' (p. 76, Engl. Trans.). It may be here remarked that words peculiar to any dialect were called by the Greeks γλῶσσαι (Aristot., *Poet.*, c. 21); whence γλωσσάριον, or glossary, meant originally a collection of such γλῶσσαι.' (*Quarterly Review*, vol. xxii., p. 305.) Afterwards a *gloss* came to mean any comment, and was applied to the commentaries on the *Corpus Juris* made in Italy in the middle ages.

Provincial dialects are chiefly preserved among the humbler and illiterate classes; educated persons generally speak the literary language of the country. Moreover they are chiefly preserved in rural districts; and thus many of the provincial words relate to agricultural subjects. (Preface to Boucher's *Glossary*, p. xliv.) In Fielding's time, country gentlemen in England often spoke the provincial dialect of their county, as may be seen by Squire Western's language in 'Tom Jones.'

Provincialisms, being either antient classical words, actually obsolete in the literary language, or diverging words or forms in a parallel dialect, are genuine remains of the antient language of the country. In this respect they differ materially from the following classes of words:—1. Low, vulgar, or obscene words, which are of universal or general currency, and are not confined to any particular locality. (Grose's *Dictionary of the Vulgar Tongue*, and the *Dictionnaire du Bas Langage*.) 2. Slang or cant expressions, used by gypsies and thieves for the purpose of concealing the subject of their conversation in the presence of persons who are not their accomplices (called *gergo* by the Italians, *ergot* in French, and *germania* in Spanish). A glossary of the slang of the London thieves (which however seems to be very variable) is appended to Hardy Vaux's 'Memoirs.' A slang or cant language is often formed among classes of persons following any peculiar pursuit; thus there is a slang of the prize-ring and the stable in this country, and there is said to be a slang among bull-fighters in Spain. 3. Technical words, such as the peculiar language of sailors or miners. 4. Neologisms, such as the words *talented*, *jeopardise*, in English.

Collections of provincial words are important in a philological point of view, as throwing light on the formation, structure, and analogies of languages; they are also important in a historical point of view, as illustrating the changes in the language of a country.

The glossaries of provincial words which have been published in different countries are very numerous, though in general they have been made with little philological skill or knowledge, and are meagre in the explanations and illustrations of the meanings of the words. The limits of the present article do not permit us to give a list of the title-pages of even the principal provincial glossaries: but we will enumerate some of the dialects of the chief European languages of which glossaries exist. For the Italian there are glossaries of the Sicilian, Neapolitan, Venetian, Bolognese, Ferrarese, Veronese, Mantuan, Brescian, Bergamasque, Milanese, and Piedmontese dialects. There are also short popular poems published in all or most of the Italian dialects. (Denina, *Mémoires de l'Académie de Berlin*, 1797; *Classe des Belles-Lettres*, p. 64-90; Adelung's *Mithridates*, vol. ii., p. 496-528.) We are not aware of the existence of a glossary of any Spanish dialect; an account of the Catalonian dialect, which closely resembles the *langue d'oc*, may be seen in the 'Mélanges sur les Langues et Patois,' p. 297-431, Paris, 1831. Dictionaries of the *langue d'oc* and of some of its varieties, as the Provençal and Limousin, exist. Copious specimens of the dialects of the French, or *langue d'oil*, may be seen in the 'Mélanges sur les Langues et Patois,' above cited. There are likewise glossaries of the Walloon French, and of the French of Geneva. For the German language glossaries exist of the dialects of the following countries and districts:—Austria, Bavaria, Esthonia and Livonia, Frisia, Hamburg, Henneberg, Holstein, Mark of Brandenburg, Meissen, Upper Palatinate, Pomerania and Rügen, Prussia, Saxony and Thuringia, Lower Saxony, Silesia, Suabia, German Switzerland, Westerwald, Westphalia. There are likewise general glossaries of Low German (platt-deutsch), of Southern German, and of the dialect of the German Jews (Jüdisch-deutsche Mundart). For the English language there are glossaries of the dialects of Nor folk, Suffolk, Sussex, Devonshire, Somersetshire, Cornwall, Herefordshire, Cheshire, Lancashire, Yorkshire, Cumberland, Westmoreland, and Northumberland; to which may be added Jamieson's 'Scottish Dictionary.'

A copious list of works illustrating the provincial dialects of England has been recently published in London.

As several persons appear to be engaged at present in making collections of provincial words in England, we may be permitted to remark that the principal defect of the provincial glossaries which have been hitherto published in this country consists in the brevity and vagueness of the explanations of the words, and the want of illustrative examples of their usage in conversation.

PROVINS. [Seine et Marne.]

PROVISIONS, PROVISORS. [Præmunire.]

PROVOST, a term having its origin apparently in the Latin *præpositus*, which denotes the chief of any society, body, or community. In France the corresponding word *prévôt* approaches nearer the original form. In that country it is applied to the persons who discharge the functions of many different offices, but in England it is rarely used: we believe the only instances are those of the heads of certain colleges, as Eton, King's College (Cambridge), &c. But in Scotland it is used to designate the chief officer in cities, as the provost of Edinburgh or of Glasgow, where in England the same officer is called the mayor.

PROVOST-MARSHAL, a term adopted from the French, who call an officer with similar functions the prévôt des maréchaux de France, or at least did so before the Revolution. The English provost-marshal is attached to the army, his duty being to attend to offences committed against military discipline, to seize and secure deserters and other criminals, to restrain the soldiery from pilfering and rapine, to take measures for bringing offenders to punishment, and to see to the execution of the sentences passed upon them.

PROX, Mr. Ogilby's name for his last genus (the sixth) of *Cervidæ*, the type being *Prox moschatus* (*Cervus Muntjac*). [Deer, vol. viii., p. 362.]

The following are the genera comprised under Mr. Ogilby's family *Cervidæ*, which he makes the second of the order *Ruminantia*, the *Camelidæ* being the first, and the *Moschidæ* the third; assigning to *Cervidæ* the following character:—

Feet bisulcate; *horns* solid, generally deciduous, in the male only or in both sexes; incisor teeth (*dentes primores*) above, nine; below, eight.

Genera.

1. *Camelopardalis*. Horns in both sexes permanent, simple, covered with skin.

2. *Tarandus*. Horns in both sexes, subpalmated, deciduous. Type.—*The Reindeer, Cervus Tarandus.*

3. *Alces*. Horns in the male only, palmated, deciduous. Type.—*The Elk, Alces Muchlis* (*Cervus Alces*, Linn.).

4. *Cervus*. Horns in the male only, ramose, deciduous. Types.—*The Stag, C. Elaphus* and *Cervus Saumer*, or *Hippelaphus*, Cuv.

5. *Caprea*. Horns in the male only, subramose, deciduous. Type.—*The Roe, Caprea Capreolus.*

6. *Prox*. Horns in the male only, subramose, deciduous. Type.—*The Muntjak.*

PROXY. [Lords, House of.]

PRUDE'NTIUS, AURE'LIUS, born in Spain, A.D. 348, followed the profession of the law, and was employed in some official situation in his native country under the reign of Honorius. About the year 407 he repaired to Rome, partly on business, and partly, it seems, from religious motives. He afterwards returned to Spain, where he spent the rest of his life in pious practices and studious pursuits. The precise time of his death is not known. Prudentius wrote several works in Latin verse. Two books are entitled 'Orations' against Symmachus, prefect of Rome, who had addressed a petition to the emperor in the name of the senate of Rome for the re-establishment of the temples and rites of the old religion. [Orosius.] Prudentius exposes the absurdity and abominations of the heathen mythology, and the corruption resulting from the want of a moral check, in which the old heathen religion was deficient. Towards the end of the second, he eloquently descants against the cruel practice of gladiators' combats for the amusement of the people; and in order to show their brutalising influence, he instances a vestal attending in the amphitheatre, and witnessing the struggles and agonies of the fallen gladiators in the arena, exclaiming with joy that such sights were her delight, and giving without compunction the signal to dispatch the fallen:

> 'Et quoties victor ferrum jugulo inserit, illa
> Delicias ait esse suas; pectusque jacentis
> Virgo modesta jubet, converso pollice, rumpi.'

Arnobius (b. iv.) towards the end casts a similar reproach upon the vestals.

Prudentius wrote also: a series of sacred hymns, which have considerable poetical merit, and some of which have been inserted in the Liturgy of the Roman Catholic church; 'Psychomachia,' which is a description of the struggles between passion and duty in the human soul; and several books against the Marcionites and other heretics. One of the best editions of the works of Prudentius is that of Parma, 2 vols. 4to., 1788.

PRUNING. [Planting.]

PRUNUS is a genus of arborescent Rosaceous plants, which belongs to the Amygdaleous division of the order, and comprehends several of our domestic fruits. The Cherry, Bird Cherry, Plum, Damson, Sloe, Bullace, and Apricot are all comprehended in the genus as limited by Linnæus. But, in the opinion of some modern botanists, the true Plums require to be separated from the others, and should exclusively constitute the genus Prunus, while the others are to be considered as belonging to two other genera represented by the Cherry and the Apricot. In this view of the subject, each genus is characterised thus:—

Armeniaca, or the *Apricot*. Drupe woolly outside. Stone blunt at one end, sharp-pointed at the other, with a furrow passing all round it, and an even surface. Young leaves rolled up.

Cerasus, or the *Cherry*. Drupe smooth, without bloom. Stones roundish, smooth. Young leaves folded flat.

Prunus, or the *Plum*. Drupe smooth, covered with bloom. Stone sharp-pointed at each end, furrowed all round, and smooth on the surface. Young leaves rolled up.

Of the Plum genus, thus restricted, there is in common use the Garden Plum (Prunus domestica), with all its numerous varieties, the Bullace (P. insititia), and the Sloe (P. spinosa). These plants are distinguished specifically by botanists, but apparently without reason. It is the opinion of the best experimental physiologists that the Sloe of our hedges was the origin of the others; and certainly there is not more difference between a Sloe and a Greengage than there is between a German Quetsche and an English White Magnum-Bonum. Several other species belong to the genus, but they are of no moment, with the exception of a plant called Prunus Coccomilia, which inhabits the mountains of Calabria, and has a great reputation in Italy on account of the tonic qualities of its bark.

PRURI'GO is a disease of the skin characterised by an eruption of small pimples and a most intense burning sensation of itching. The pimples are usually but slightly if at all red, and the skin between them has its natural colour. They are generally seated about the shoulders, back, and neck, but often also on the limbs, and in severe cases even on the face and over a great part of the body. Their course is always very slow, and they are not infectious.

There are three principal varieties of Prurigo, namely, P. mitis, P. formicans, and P. senilis; and besides these, some others are distinguished by the names of the parts which are in each exclusively or chiefly affected.

The Prurigo mitis is the mildest form of the disease. The pimples are very small, and so pale that they can scarcely be discerned, till, by the scratching, which is almost unavoidably resorted to in order to relieve the intolerable itching, their tops are torn off, and become covered by little black scabs of dried blood.

In P. formicans all the symptoms of the disease are more severe, and the itching by which they are accompanied is united with a painful burning sensation in the skin, as if, patients say, hot needles were constantly piercing it. Both this and the preceding form of Prurigo may disappear with a slight desquamation in a few weeks, but more commonly a succession of eruptions follow one another, and the disease is prolonged for months or even years. Both of them occur in persons of all ranks and ages, but they are more common in the young and in the old, and among those who enjoy fewest of the comforts of life. They are not attended by any important constitutional disorder.

Prurigo senilis, which is by far the worst form of the disease, occurs almost exclusively in enfeebled children and old people. It usually lasts for years, producing all the time almost intolerable suffering by the intense itching that attends it, and which scarcely admits of relief by any known means. The pimples are usually very numerous, and often hard and prominent; the skin between them is also often thickened and indurated, other eruptions break out upon it, and if cleanliness be not carefully observed, it becomes infested with swarms of lice.

The treatment of the two first forms of Prurigo must consist of a mild antiphlogistic regimen, tepid baths, and the use of alkalis both externally and internally. Stimulants of all kinds greatly increase the pain and itching, but they may sometimes be relieved by the application of ointments or lotions containing small quantities of opium, or Prussic acid, or cyanuret of potassium. In the Prurigo senilis the regimen must be more nutritious, and tonic medicines are useful; but in this form, as well as in the others, stimulants must be avoided. If the skin is infested with pediculi, the most effectual mode of destroying them is fumigation with the vapour of cinnabar. In this form also sulphur-baths are among the few means that will produce any relief. The alkaline lotions, which may be used in all cases, may be composed of one or two drachms of carbonate of potash to the pint of water, or of from one to three drachms of sulphuret of potash to the same quantity of water, the strength being determined by the irritability of the skin, and being always made less than sufficient to excite any heat or redness in it.

PRU'SIAS. [BITHYNIA.]

PRUSSIA consists of two great divisions, which are unconnected with one another. The western and smaller portion is situated on both sides of the Rhine, and called Rhenish Prussia (Rhin-Preussen). It extends between 49° and 52° 15′ N. lat., and between 6° and 9° 30′ E. long., and on the south borders on the French department of Moselle. On the west of it lies Belgium and Holland, and on the north the kingdom of Hanover. Portions of the last-mentioned country, with Brunswick, Lippe, Waldeck, and the electorate of Hesse, extend along its north-eastern boundary-line, and separate it from the larger portion of the Prussian monarchy. Farther south it borders on Nassau, Hesse-Darmstadt, and that portion of Bavaria which lies west of the Rhine. It comprehends an area of about 18,550 square miles, or about three-fourths of the area of Scotland.

The eastern and larger portion of the Prussian monarchy, more properly called Prussia, though, strictly speaking, only the eastern portion of it bears that name, extends from 49° 50′ to 55° 50′ N. lat. and from 9° 50′ to 12° 50′ E. long. On the north-west of it lies Mecklenburg; on the west Hanover, Brunswick, and the electorate of Hesse.. Along the southern boundary are the duchies of Saxony, the kingdom of Saxony, and several portions of the Austrian monarchy, and along the eastern side are the kingdom of Poland and Russia. The area of this portion is about 91,620 square miles, or about 7000 square miles more than the surface of Great Britain. The whole Prussian monarchy has a surface of 110,170 square miles, which is about 2000 square miles less than that of the British Islands.

Surface and Soil.—I. Rhenish Prussia is divided into two equal portions by the Rhine, and each of these divisions consists of an elevated table-land and a low plain. The table-land on the west bank of the Rhine is connected on its south-eastern border with the Hardt Mountains, as the northern extremity of the Vosges is called. It extends over that part of Bavaria which is situated on the west side of the Rhine. The Hardt Mountains attain an elevation varying between 1100 and 1600 feet, and the highest summit, the Calmet or Kalmuck, is above 2000 feet. From this mountain-region the table-land extends northward to the parallel of the towns of Bonn and Aachen (or Aix-la-Chapelle). Along the south-eastern banks of the river Moselle is the highest part of the table-land, which appears in the shape of a range elevated on a very high base. Part of this range is called the Hochwald, and another part the Soonwald: its mean elevation is more than 2000 feet above the sea-level, while the highest summit, called the Walderbsenkopf, attains nearly 2690 feet. The larger part of the table-land lies to the north of the Moselle river, and is called the Eifel, and in its northern districts the Hohe Veen. The mean elevation of this part is about 1600 feet, and it may be called a plain; neither the eminences nor the depressions are great. A few hills rise from 500 to 700 feet above it. This region has lately attracted much attention, on account of the unequivocal traces of volcanic action which it presents in its basalts and trachytic formations. Geologists have discovered some craters which are now filled with water, and are thus converted into small lakes. Tracts of lava are frequent, and amidst them are conical hills resembling in form active volcanoes. The soil of the table-land is very poor, and produces only moderate crops of oats and potatoes, where it is cultivated. The tracts which are not cultivated are partly rocks, overgrown with peat and moss, and partly swamps, which are very extensive on the Hohe Veen. In other places tracts of sand occur. The soil in the valleys with which the edges of the table-land are furrowed, is much better, and especially the valleys of the Moselle and Rhine; but even here the fertility is only moderate, with the exception of a district surrounding the town of Trier (Treves), where good crops of wheat are raised. As far as this region lies within Prussia, it does not appear to contain metals or any useful minerals.

The level country which extends from the northern border of the Eifel and Hohe Veen, between the Rhine and the Maas, is nearly a flat which sinks imperceptibly as we proceed northward. Its fertility is considerable, and it produces rich crops of all kinds of grain.

Opposite the table-land of the Eifel, on the right bank of the Rhine, is a similar table-land, which extends southward through Nassau, where it rises along the banks of the Main and Rhine to a more elevated ridge known under the name of Taunus, which, like the Hochwald and Soonwald, attains a mean elevation of 2000 feet; and its highest summit, the Feldberg, is 2850 feet. From the Taunus the table-land extends northward, and terminates on the northern bank of the river Ruhr, an affluent of the Rhine. It extends about 40 miles farther north than the table-land west of the Rhine, and, between the Lahn and Sieg rivers, is called Westerwald; and, between the Sieg and Ruhr, Sauerland. The mean elevation of this district does not differ from that of the Eifel, being also about 1600 feet above the sea-level. But the surface is more uneven, especially that of the Westerwald, which contains several high summits, among which the Salzburgerkopf is 2172 feet high. Lava, trachyte, and basalt are also frequently met with in the Westerwald, but not north of the Sieg river. The soil of the whole region is poor; and it is unsuited for the production of any grain except oats, which supply the inhabitants with bread. The population is considerable, especially on the Sauerland, which is, without exception, the most manufacturing district in Germany, a circumstance owing to the abundance of iron and coals which this part of the table-land contains.

The Rhine separates the two table-lands just mentioned, and runs in a narrow valley which is noted for its picturesque beauties. It begins to run between the mountains at Bingen, where its surface is a little more than 200 feet above the sea-level. It leaves the mountain-region at Bonn, where it is not more than 120 feet above the sea. In a course of about 70 miles it falls more than 80 feet. Between Bonn and Düsseldorf, a distance of nearly 50 miles, the fall is only 26 feet.

That portion of Rhenish Prussia which lies to the north of the Sauerland, and extends to its northern limits, has a soil which varies greatly in fertility. The western portion of it, from the Rhine to the banks of the Ems, is nearly a desert: the cultivable ground, which only occurs in isolated places, is only a small portion of the whole. On the east of the Ems the soil is much better, especially as we approach the hilly country, which extends along the western side of the river Weser, where wheat is raised: some good tracts occur also along the northern declivity of the Sauerland, but they are not extensive.

II. The Eastern and larger portion of Prussia is a part of the great plain of Eastern Europe, which extends from the Straits of Dover to the foot of the Uralian Mountains. Mountains occur only along the southern boundary. On the boundary of Prussia and Bohemia is that mountain-range which bears the general name of the Sudetes, and whose northern portion is called Riesengebirge, or Giant Mountains. There are mountains also on the line which separates Prussia from Saxony. Where the south-western angle of Prussia is intersected by the duchies of Saxony and the territories of he princes of Reuss, and partly also by Hanover, it comprehends parts of the two mountain-systems of the Thüringerwald, or mountains of Thuringia, and of the Harz.

The Sudetes are not connected with the Carpathian Mountains. At the north-western extremity of the last-mentioned range there is a nearly level plain, between 45 and 50 miles wide, on which the Oder rises.* This plain is only 600 or 700 feet above the sea-level; and it descends on the north along the course of the river Oder with a gentle slope, but rapidly towards the south. On the north-western edge of this plain the southern extremity of the Sudetes commences with the mountain-plain of Glatz, which is surrounded by elevated ranges. It rises with a steep ascent, and extends in a north-western direction for about 70 miles, when it again descends with a similar slope. Its interior, the mountain-plain of Glatz, is between 1200 and 1300 feet above the sea; but the ranges which surround it rise to 3500 and 4300 feet. The highest summit, which lies at the south-eastern corner of the mountain-mass, is called the Altvater, and is 4281 feet above the sea. The whole region occupies a width of about 27 miles, and is called the Mountains of Glatz. Between the northern extremity of this range and the Giant Mountains is a tract the surface of which is chiefly occupied by high hills and low mountains; but its mean level above the sea does not exceed 1500 feet. It is followed in the same north-western direction by the Giant Mountains, which, for more than 30 miles, continue as a chain of equal elevation, whose upper part is nearly 4800 feet above the sea. In the middle of the chain, where the river Elbe rises, on its western declivity, is the Schneekoppe, also called Riesenkoppe, which is 5291 feet above the sea-level, and is the highest mountain in Germany except the Alps. The width of this range is about 14 miles, and the country at its north-eastern base is from 1500 to 1800 feet above the sea. The greatest part of this mountain-system is covered with wood, chiefly pine and fir, and only a small part of the valleys, which are rather narrow, is fit for cultivation. The higher part of the mountains rises above the line of trees, but does not attain the snow-line.

The Thüringerwald, which is at the south-western extremity of this part of Prussia, is a mountain-range nearly fifty miles long, but only from eight to twelve miles wide. The mean elevation may be 2000 feet above the sea, and the highest summit, the Great Beerberg, is 3258 feet. A very small part of this range lies within the boundary of Prussia. The Harz is about fifty miles distant from the Thüringerwald on the north. The western and higher portion of this mountain-system lies within the kingdom of Hanover. Only the eastern and lower portion belongs to Prussia: in this part the range attains an elevation of about 1500 feet. The Brocken, which is 3729 feet high, stands near the point where the boundary-line between Hanover and Prussia runs across the range. The greater part of the country which lies between the Thüringerwald and the Harz belongs to Prussia; its general level may be about 900 feet above the sea, but some hills rise several hundred feet higher. The soil of the valleys, most of which are wide, is generally of excellent quality.

The great plain is not a dead level, like some parts of the interior of Russia, but the surface is diversified by several moderate elevations. Two of these traverse this portion of Prussia from east to west in its whole extent. The northern elevation runs generally parallel to the Baltic, and the southern in its eastern portion parallel to the Sudetes. The northern elevation is a portion of that high ground which extends eastward from the mouth of the river Elbe, at a varying distance from the Baltic, to the sources of the river Volga, through a space of more than 1000 miles. It is remarkable for the number of lakes dispersed over its broad surface and on the upper part of its slopes, and for the quantity of erratic blocks of granite which are imbedded in the surface. On the eastern boundary of Prussia it occurs near 54° N. lat., and it runs near its southern boundary between 23° and 19° E. long., but is comprehended within the territories of Prussia. The mean height of this part of the elevated ground may be about 450 feet above the sea-level, and the lakes are more numerous than in any other part of it, and some are of considerable extent. The lake of Spirding occupies an area of more than twenty square miles, and is nearly 400 feet above the sea-level; the lake of Mauer is nearly as large, and about 410 feet above the sea. The larger lakes taken together occupy a surface of 312 square miles, and the smaller lakes are very numerous. The soil is sterile, chiefly consisting of loose sand, covered in many places with heath, and in others with stunted pines. The portion of cultivable land is very small; that which supplies indifferent pasture for cattle and sheep is not much larger.

From this elevation the country slopes to the shores of the Baltic with an undulating surface, which is seldom varied by a hill. The soil improves as we advance northward, and as we approach the shores of the Frisches Haff and the banks of the rivers Pregel and Niemen it contains extensive tracts of great fertility. The most productive parts occur along the banks of the Niemen and Vistula, where the low river-bottoms are of great extent, and are protected against the inundations by embankments. The embankments were erected along the Vistula, more than six hundred years ago, by the Teutonic knights: they are above 150 miles long. The country which is thus secured from inundations contains an area of nearly 750 square miles, and is by far the most fertile tract in the Prussian monarchy.

The elevation is interrupted by the wide valley of the Vistula, and on the west side of the river it does not rise opposite to the termination of the eastern portion, but much farther to the north. It begins about twenty-five miles south-west of Danzig, with a rather steep ascent, and attains its greatest elevation in the Thurmberg near Schönberg, which is nearly 1070 feet above the sea, and is the highest hill between the Harz and the Ural mountains. From this place it extends in a south-western direction towards Behrendt, and thence to Märkisch Friedland, which is on the boundary-line between Prussia Proper and Pomerania. So far it resembles in all its features a mountain-system of a diminutive size. It continues with a less elevation and more extended slopes along the boundary-line between the provinces of Pomerania and Brandenburg, and terminates in abrupt hills not far from the banks of the Oder opposite Schwedt and Oderberg. The soil of this elevation is much better in this part than it is farther east, but it is only of very moderate fertility. To the south-east of the higher portion of the elevation extends the greatest waste in the Prussian monarchy, called the Tuchler Heide (Heath of Tuchel), which is fifty miles in length and from twenty to twenty-five in width. The soil is sandy, and, with the exception of shrubs and stunted pines, it produces scarcely anything which is useful to man. The spots of cultivable ground are few and of small extent. Towards the south, where it approaches the river Netze, an affluent of the Warta, the soil improves, and it is still better between the two last-mentioned rivers, but even here the fertility is not great. Between the Warta, where that river runs north, and the Vistula, there is a large tract of country which yields abundant crops of wheat and other grain. The tract which extends along the lower course of the Warta to the banks of the river Oder, is much less fertile. On the northern side of the elevation the country is of moderate fertility, but it improves as we approach the shores of the Baltic. A few miles from the sea there is a tract several miles wide, which may be called fertile, but the shores consist of sand-hills which extend two or three miles inland, and occupy the whole coast from the eastern mouth of the Oder to the fertile delta of the Vistula near Danzig.

The Western portion of the elevation begins on the west of the Oder, between Schwedt and Oderberg, and runs west-north-west until it enters the duchy of Mecklenburg, through which it extends to Holstein and the banks of the Elbe. Its mean height is here probably less than 300 feet above the sea-level, and the surface is rather uneven, several hills rising from 100 to 200 feet above it. The soil of that part which is within Prussia is of moderate fertility; but along its northern declivity, and as far as the shores of the Baltic, including the island of Rügen, it consists of very good land, which yields large crops of grain.

The Southern elevation of the Prussian plain is connected at its eastern extremity with the mountains of Sandomir in Poland [POLAND], and with those surrounding the mining town of Olkusz, north-east of Cracow. From this point it runs in a west-north-west direction along the eastern boundary-line of the province of Silesia, where it rises to about 1000 feet above the sea-level north of the town of Breslau. In this part it is called the Heights of Trebnitz. The elevation is interrupted by the valley of the Oder between Leubus and Great Glogau, and farther on by the Bober, Neisse, and Spree; but it appears south of Berlin, where it is called the Fleming, and is 400 feet above the sea, or 300 feet above the site of the Prussian capital. It terminates not far from the banks of the Elbe, between Magdeburg and Burg; but a continuation of it appears on the western side of the Elbe, and after leaving the Prussian dominions, continues between the Elbe and the Weser to the vicinity of the North Sea between the mouths of these two rivers. In these parts it is very wide, and comprehends the Heath of Lüneburg, which belongs to the kingdom of Hanover.

The country which lies between the two elevations, west of the meridian of 19°, is not distinguished by fertility, except in some of the river bottoms. Berlin lies in a sandy desert, which contains only small isolated tracts of fertile ground; and this sterile country, in some parts overgrown with fine forests, extends northward to the boundary-line of Mecklenburg, and southward to the Fleming. To the east and west of this waste, on both sides of the river Oder, and towards the banks of the Elbe, the country is much better, but still not very fertile.

The country to the south of the southern elevation is more favoured by nature than the other parts of the Prussian monarchy. Completely sterile tracts are rare, and of small extent, with the exception of one which forms the southern district of Silesia, and is contiguous to the boundary-line of the Austrian dominions and of Poland. The remainder of Silesia is fertile, especially the plain, which extends on the left bank of the Oder from Oppeln to Liegnitz. The same observation applies to the province of Saxony, as far as it lies south of the southern elevation; the country about the town of Magdeburg is noted for its fertility, and is considered the granary of Berlin.

Climate.—Numerous meteorological observations have been made in all parts of the Prussian monarchy, and their results have been compared. The difference of temperature in the provinces is considerable. Berghaus has divided Prussia, as to climate, into three sections, the western, central, and eastern divisions. The first is formed by Rhenish Prussia, and the last by Prussia Proper; the remainder of the monarchy constitutes the central division. He gives the following table:—

			Mean Temperature of Fahrenheit.				
	Latitude.	Elevation above the Sea-level.	Of the Year.	Of the Summer.	Of the Winter.	Coldest Month.	Warmest Month.
Western division	51°	feet. 250	49½°	63°	35°	33°	64°
Central division	52° 30′	210	48°	64°	33°	29°	65°
Eastern division	54° 30′	40	43°	61°	26°	24°	62½°

From this table it is evident that the difference of the mean temperature in winter in the western and eastern divisions amounts to nine degrees, but in summer it does not exceed two degrees and a half. If we compare the climate of these divisions with that of London, we find that the mean annual temperature of London is about one degree greater than that of the western division, and exceeds by nearly eight degrees that of the eastern. But as the mean temperature of the summer in London is only 61·2°, the western and central divisions of Prussia experience at that season a greater degree of heat than the British metropolis. The winter however in London is much milder, as the average temperature of this season is 39·3°. Berghaus observes, that the mean annual quantity of rain in the western division amounts to twenty inches, and only to fifteen inches in the eastern division, but it is nearly impossible to determine this point, as the latter division annually experiences very heavy falls of snow, which it is nearly impossible to estimate, on account of the drift-storms, which accumulate the snow in some places to a great depth, whilst other places, which are exposed to their whole force, are quite bare. The prevailing winds in Prussia, as all over the west of Europe, blow from the west, and frequently with great force.

Rivers.—In Rhenish Prussia is the Rhine, which traverses this division of the monarchy from south to north, and is navigable for large vessels as far as it flows through the Prussian dominions. As far as Cologne (Köln) it may be ascended by sea vessels of moderate size. Its course above Bonn is rapid, and in some places eddies occur, but they are not dangerous. Several rivers join the Rhine from the east and west. From the east it receives the Sieg, on which timber is floated, and which is also navigable for four or five miles from its mouth; the Wipper, farther north, which is only navigable for a short distance from its mouth; and the Ruhr and the Lippe, both of which are navigable for 30 or 40 miles from their junction with the Rhine. On the left the Moselle falls into the Rhine, and is navigable in the whole of its course through the Prussian dominions, an extent of more than 150 miles.

In the eastern provinces of Prussia four large rivers, the Elbe, Oder, Vistula, and the Niemen, traverse the elevations which run through them from east to west. Between the two elevations however the affluents of these rivers run east and west, and as many of them are navigable for river boats, they facilitate the intercourse between the countries on their banks. The navigable affluents of the Elbe, from the west, are the Saale, which begins to be navigable where it enters Prussia, the Unstrut, and the Elster; and from the east, the Havel, which is joined by the Spree: the course of the Havel is nearly 250 miles, measured along the windings, and it is navigable for about two-thirds of that distance. The navigable affluents of the Oder from the east are the Klodnitz, in southern Silesia; the Bartsch, which is navigable from Militch downwards; the Warta, which is navigable before it leaves Poland and enters Prussia, with its navigable tributary the Netze; and from the west, the Bober, the Neisse, and the Finow. The lake into which the Oder discharges its waters before it enters the Baltic, receives the two navigable rivers, the Ucker and the Peene; by the latter sea vessels of moderate size can ascend to the town of Demmin. The Vistula receives from the west the Brahe, which becomes navigable at the town of Bromberg. Between the Oder and the Vistula is the Persante, which runs more than 100 miles, and is navigable more than 20 miles from its mouth in the Baltic. The Elbing river rises in the lake of Drausen, and though its course is not long, it is navigable, and of great importance to the town of Elbing: it falls into the Frisches Haff. Farther east the same lake receives the Passarge, which is navigable for small sea vessels to the town of Braunsberg, four miles from its mouth. The Pregel, which also falls into the Frisches Haff, is navigable as far as Insterburg for large river vessels, and to the town of Königsberg for vessels of 300 tons burden. A river, which is united with the Pregel by a canal, runs to the Kurisches Haff; it is navigable for large river boats, and called the Deime. The Niemen or Memel is navigable in the whole of its course through Prussia; it receives from the north the river Yura, which about ten miles from its mouth is navigable for small river boats; and from the south the Scheschuppe, which is navigable about 25 miles upwards. The last river which requires mention is the Dange, which comes from Russia, and enters the Kurisches Haff at its most northern extremity, where it forms a part of the harbour of the town of Memel. Vessels of more than 500 tons burden can enter the river and unload in the middle of the town.

Natural Productions.—Prussia does not possess a great variety of natural productions, but it has all those the cultivation of which has been gradually introduced into central Europe, and the most indispensable of them in sufficient abundance for its own consumption, and for the obtaining of foreign luxuries and comforts. Of domestic animals, according to the latest accounts that we have seen, and which appear to have been published about six years ago, there are—horses 1,500,000, the breed of which has been much improved of late years, especially in the eastern provinces, by numerous studs; horned cattle 513,180; sheep, at least 12,650,000 in round numbers, viz. 2,600,000 Merinos, 5,450,000 of an improved breed, and 4,600,000 not improved; goats, 200,000, are bred only in the mountainous parts of Silesia, Saxony, and Westphalia; swine, 2,000,000, are chiefly bred in Pomerania, Saxony, the provinces of the Rhine, and above all in Westphalia, the hams of which country have long been celebrated. There are likewise asses, chiefly in Westphalia, and mules. Of wild four-footed animals there are: 1, fit for food—stags, fallow-deer, wild boars, hares, and rabbits. The great northern hare is sometimes met with. 2, Beasts of prey and fur-bearing animals—wolves, foxes in abundance, bears rarely, lynxes, beavers, badgers, pole-cats, otters, weasels, and martens; the ermine is very rare. Domestic poultry of all kinds abounds; and of wild-fowl, besides what we call game, as pheasants and partridges, there are such immense numbers of wild geese as frequently to do great injury to the farmers. Smoked geese are an important article of exportation from Pomerania. Of birds of prey, there are the eagle, the sparrow-hawk, the kite, and some others. Fish of various kinds are extremely abundant, as well in the numerous rivers as on the long line of coast on the Baltic. In all the provinces where there are heaths, buckwheat, and lime-trees, great quantities of bees are bred, in all 600,000 hives. The breeding of silkworms has been greatly increased within the last twenty years, and promises to become very important.

Agriculture.—Agriculture is the chief source of the national wealth, and is carried on with great care in most of the provinces. Wheat, rye, oats, and barley are raised both for home consumption and exportation; there are likewise peas, beans, vetches, millet, maize, rapeseed, and linseed. Potatoes are cultivated in all the provinces. Flax, hemp, hops, tobacco, succory, beet-root, and garden vegetables of all kinds are raised; but of the first three articles not enough for home consumption. Fruit might be more extensively cultivated than it is. Considerable pains are taken with it in Pomerania; but the most productive provinces are Saxony and Rhenish Prussia. The cultivation of the vine has been greatly extended since the peace of 1815. The most and best wine is made in Rhenish Prussia; of 55,000 acres of vineyards, 44,000 are in that province. On the whole Prussia has abundance of timber: the principal forests are in Prussia proper and Silesia; but some provinces, for instance part of Saxony, have not sufficient. The mineral products are salt from salt-springs, of excellent quality and in great abundance, amber, and coals in large quantities; alum, vitriol, saltpetre, alabaster, basalt, granite, porphyry, marble, slate, freestone, chalk, lime, porcelain-clay, pipe-clay, &c. The metallic products are silver, copper, lead, iron, zinc, cobalt, arsenic, and calamine. The precious stones are the onyx, agate, jasper, and cornelian.

Manufactures.—The principal manufactures are:—linen in all the provinces, but chiefly in Silesia; woollen cloths and cotton goods, especially in the province of the Rhine, at Elberfeld, Barmen, Crefeld, &c.; silk, leather, iron and copper ware, cutlery, articles of gold and silver, succory, paper, china, glass, earthenware, snuff and tobacco, sugar (the manufacture of beet-root sugar is making great progress), gunpowder, &c.; the breweries and brandy distilleries are very considerable.

Commerce.—The abundance of products of various kinds, and the active industry of the people, give occasion to an extensive commerce, which is highly favoured by the advantageous position of the country in the centre of Europe, the great extent of coast on the Baltic, and by the great rivers (the Rhine, the Elbe, the Oder, and the Vistula) which traverse the country and are connected by navigable tributary streams and numerous canals. The commerce of Prussia extends to almost all the states of Europe, to America, and even to China; but its chief commerce is with Austria and the other states of Germany, with England, Russia, Sweden, Denmark, and the Netherlands. The principal articles of export are the natural productions and the most important of the manufactures enumerated under the two preceding heads. The chief articles imported are:—raw and refined sugar, coffee, tea, spices, cotton, silk, tobacco, hops, tin, saltpetre, dye-stuff, wine, glass, and various manufactures, chiefly printed calicoes, silks, and fine hardware. It is not easy to ascertain the annual value of the exports and imports previously to 1831. That of the imports, says Dieterici, cannot be less than from ten to twelve millions sterling. The exports seem to have exceeded that sum. In 1831 the celebrated Prussian or German commercial league commenced, and has been since been gradually joined by almost all the German states. The effect of this league (or, as it is called in German, Zollverein, *i.e.* customs union) is not yet fully developed. The object is to establish an entire freedom of trade among the German states, and to subject foreign trade to such restrictions only as the protection of national manufactures or the financial circumstances of the state may render necessary. The result in the years 1831-1836 has been published, from official sources, by Dr. Dieterici, in a very elaborate work, in 1838. The harbours are:—Memel, Pillau, Neufahrwasser near Danzig, Stolpermünde, Rügenwalde, Kammin, Schweinemünde, Peenemünde, Greifswald, Stralsund, and Barth. The most considerable commercial towns are:—Berlin, Königsberg, Danzig, Breslau, Stettin, Magdeburg, Cologne, Elberfeld, and Aix-la-Chapelle. The great fairs are those of Breslau, Frankfurt-on-the-Oder, and Magdeburg.

Religion.—There is, properly speaking, no state religion That of the royal family and of the majority of the people is Calvinism; but Christians of all denominations are equally admissible to all public employments. The year 1817, which was the three hundredth anniversary of the Reformation, was remarkable for the union of the Calvinists and Lutherans in Prussia, and in some other parts of Germany, into one religious body, under the name of Evangelical Christians. These amount in Prussia to about 8,000,000, the Roman Catholics to about 5,000,000, the Mennonites and Moravians to about 15,000: there are likewise French Protestants, the descendants of the refugees; and nearly 200,000 Jews.

Education.—The Prussian government pays great attention to the diffusion of useful knowledge, and manifests equal zeal in encouraging the lowest as well as the superior institutions. For the education of the people, there are in all the towns elementary schools, Sunday and infant schools, schools for mechanics, &c.; in fact, so much is done in this respect, that many persons complain of the too great extent and variety of things taught in these institutions. In 1835 there were 21,790 elementary schools, in which about 2,000,000 of children of both sexes were instructed: for the higher branches of education, there were, in 1832, 124 gymnasia, in which 24,461 scholars were educated. There are universities at Berlin, Bonn, Breslau, Greifswald, Halle, and Königsberg, to the support of which the government applies large sums. As to education generally in Prussia, see SCHOOL. The literary and learned societies are very numerous.

Revenue.—In the year 1835 the revenue amounted nearly 8,000,000*l.* sterling, and has not much varied since that time. The expenditure for the same year was estimated at an equal sum, of which about 1,200,000*l.* was appropriated to pay the interest of the public debt, and to the gradual redemption of it, and above 3,000,000*l.* to the war department. The debt amounted, on the 1st January, 1835, to about 27,000,000*l.* sterling, bearing interest at 4 per cent.

Army.—All subjects of the Prussian monarchy are bound to military service, which they perform successively in the standing army, the landwehr (militia) of the first and second ban, and in the landsturm (which answers to the French *levée en masse*). All men able to bear arms from twenty to twenty-five years of age belong to the standing army; they serve three years, and are then discharged for two years, during which they are liable to be called out as the reserve. All those who have served in the standing army belong to the landwehr of the first ban, from the age of twenty-six to thirty-two, both inclusive. In time of war this ban is on the same footing as the standing army, and equally liable to serve both at home and abroad. It is called out every year to exercise, in one year for a fortnight, in the next for a month, and is equipped and clothed while it serves. The second ban, which is called out only in time of war, and is then chiefly employed in reinforcing the garrisons, includes all men capable of bearing arms till the age of thirty-nine. All older men fit for service belong to the landsturm. The army consists of eight corps, besides the guards, amounting to—

	War establishment.		Peace establishment.
	Officers.	Men.	
Infantry of the line.	3,000	128,412	66,536
Cavalry of the line .	932	21,600	18,000
Artillery. . . .	899	20,970	15,570
Engineers and pioneers	219	4,050	1,800
Garrison troops .	161	5,400	5,400
Total . .	5,211	180,432	107,366
Besides—			
Landwehr of the first ban:			
Infantry . . .	2,658	118,481	
Cavalry. . . .	918	20,400	

The 6400 invalids are not included. Thus Prussia is able in time of war to have on foot an army of 8787 officers and 319,313 men; and, with the addition of the second ban of the landwehr, amounting to 180,000 (destined only to defend the country within the frontiers), a force of 500,000 men. The state maintains likewise several bodies of gendarmes. There are six fortresses in the western and twenty in the eastern provinces. The Duke of Wellington is the only field-marshal in the Prussian army.

The whole Prussian monarchy is divided into eight provinces, and these into twenty-five governments.

The following table shows the extent of the whole Prussian monarchy, the population of the provinces and governments, the number of inhabitants in a German geographical square mile (equal to about twenty-one English square miles), the principal towns, and the population, according to the return of 1837, the latest published:—

View of the Area and the Population of the Prussian Monarchy at the end of 1837.

Provinces.	Governments.	Area in German Square Miles.	Population at the end of 1837.	Inhabitants on a Square Mile.	Towns with more than 5000 Inhabitants.	
					Names of the Towns.	Population
I. Prussia.	1. Königsberg .	408·13	746,462	1829	1 Königsberg . .	64,200
					2 Memel . . .	9,034
					3 Braunsberg . . .	7,746
	2. Gumbinnen .	298·21	558,192	1872	1 Tilsit	17,179
					2 Insterberg . . .	8,386
					3 Gumbinnen . .	6,255
	3. Danzig . .	152·28	349,218	2293	1 Danzig . . .	56,257
					2 Elbing . . .	18,725
					3 Marienburg . . .	5,594
	4. Marienwerder .	319·41	499,001	1562	1 Thorn	7,668
					2 Marienwerder . .	5,246
					3 Culm . . .	5,201
					4 Graudenz . . .	5,182
	Total .	1178·03	2,152,873	1827	13 towns with more than 5000 inhab	
II Posen.	5. Posen . .	321·68	788,578	2451	1 Posen . . .	32,150
					2 Lissa . . .	8,667
					3 Rawitsch . . .	8,216
					4 Krotoschin . . .	6,337
					5 Kempen . . .	6,156
					6 Fraustadt . . .	6,064
	6. Bromberg .	214·83	381,128	1774	1 Bromberg . . .	7,396
					2 Gnesen	5,117
	Total .	536·51	1,169,706	2160	8 towns with more than 5000 inhab.	
III Pomerania.	7. Stettin . .	236·88	464,440	1960	1 Stettin . . .	33,786
					2 Stargard . . .	10,693
					3 Anklam . . .	7,131
					4 Pasewalk . . .	5,381
					5 Demmin . . .	5,318
	8. Cöslin . .	258·56	365,417	1413	1 Colberg . . .	6,657
					2 Stolpe . . .	7,798
					3 Cöslin . . .	6,900
	9. Stralsund .	79·02	160,428	2030	1 Stralsund . . .	13,900
					2 Greifswald . . .	10,291
	Total .	574·46	990,285	1721	10 towns with more than 5000 inhab.	
IV. Brandenburg.	10. Potsdam, with Berlin .	382·51	1,005,322	2628	1 Berlin . . .	265,394
					2 Potsdam . . .	25,560
					3 Brandenburg . .	13,283
					4 Prenzlau . . .	10,508
					5 Neu Ruppin . .	7,925
					6 Charlottenburg . .	6,376
					7 Wittstock . . .	6,163
					8 Spandau . . .	6,753
					9 Schwedt . . .	5,616
					10 Luckenwalde . .	5,417
					11 Wriezen . . .	5,274
					12 Rathenow . . .	5,030
	11. Frankfurt .	348·43	736,089	2112	1 Frankfurt on the Oder .	23,378
					2 Landsberg on the Warthe	9,970
					3 Guben . . .	9,256
					4 Cottbus . . .	8,216
					5 Cüstrin . . .	5,240
					6 Königsberg (Neu Mark)	5,018
	Total .	730·94	1,741,411	2382	18 towns with more than 5000 inhab.	
V. Silesia.	12. Breslau . .	248·14	1,027,799	4112	1 Breslau . . .	88,869
					2 Brieg . . .	10,947
					3 Schweidnitz . . .	9,476
					4 Glatz . . .	7,094
					5 Oels	6,037
					6 Frankenstein . .	5,365

Provinces.	Governments.	Area in German Square Miles.	Population at the end of 1837.	Inhabitants on a Square Mile.	Towns with more than 5000 Inhabitants.	
					Names of the Towns.	Population.
V. Silesia (*continued*).	13. Oppeln	243·06	807,393	3322	1 Neisse	10,785
					2 Oppeln	6,821
					3 Ratibor	6,508
					4 Leobschütz	5,681
					5 Gleiwitz	5,377
	14. Liegnitz	250·52	814,281	3370	1 Görlitz	13,670
					2 Glogau	11,615
					3 Liegnitz	11,607
					4 Grünberg	9,935
					5 Goldberg	7,093
					6 Herschberg	7,080
					7 Jauer	5,970
					8 Sagan	5,607
					9 Lauban	5,549
	Total	741·74	2,679,473	3612	20 towns with more than 5000 inhabitants.	
VI. Saxony.	15. Magdeburg	210·13	598,981	2850	1 Magdeburg, without suburb	42,528
					2 Halberstadt	17,227
					3 Burg	14,025
					4 Quedlinburg	12,903
					5 Aschersleben	9,730
					6 Salzwedel	7,285
					7 Schönebeck	7,344
					8 Neustadt Magdeburg	8,816
					9 Stendal	6,099
	16. Merseburg	186·76	652,591	3457	1 Halle, on the Saale	26,447
					2 Naumburg	11,925
					3 Zeitz	9,992
					4 Merseburg	9,413
					5 Wittenberg	8,400
					6 Weissenfels	7,668
					7 Eilenburg	7,699
					8 Eisleben	7,523
					9 Torgau	6,531
					10 Sangerhausen	5,133
	17. Erfurt	61·74	312,615	5063	1 Erfurt	24,308
					2 Mühlhausen	12,051
					3 Nordhausen	12,163
					4 Suhl	7,442
					5 Langensalza	7,142
	Total	460·63	1,564,187	3396	24 towns with more than 5000 inhab.	
VII. Westphalia.	18. Münster	132·17	405,275	3066	1 Münster	19,763
	19. Minden	95·68	417,276	4361	1 Minden	7,966
					2 Paderborn	7,895
					3 Herford	6,852
					4 Bielefeld	6,097
	20. Arnsberg	140·11	503,916	3597	1 Iserlohn	9,313
					2 Soest	7,639
					3 Dortmund	6,861
					4 Hamm	5,372
	Total	36·796	1,326,467	3605	9 towns with more than 5000 inhab.	
VIII. The Rhenish Province; sometimes called Rhenish Prussia.	21. Cologne	72·10	426,691	5894	1 Cologne	69,051
					2 Bonn	13,871
	22. Düsseldorf	98·32	766,837	7799	1 Barmen	28,975
					2 Elberfeld	26,770
					3 Düsseldorf	21,858
					4 Krefeld	23,008
					5 Wesel	10,634
					6 Burtscheid with Leichlingen	10,384
					7 Hohscheid and Merscheid	10,255
					8 Neuss	8,656
					9 Mühlheim on the Ruhr	8,172
					10 Cleves	7,687
					11 Duisberg	6,477
					12 Kronenburg	5,833
					13 Lennep	6,025
					14 Ronsdorf	6,116
					15 Essen	5,571
					16 Emmerich	5,518

Provinces.	Governments.	Area in German Square Miles.	Population at the end of 1837.	Inhabitants on a Square Mile.	Towns with more than 5000 Inhabitants.	
					Names of the Towns.	Population.
VIII. The Rhenish Province (*continued*).	23. Coblenz . .	109·64	461,907	4213	1 Coblenz and Ehrenbreitstein . . . 2 Creuznach . . . 3 Neuwied . . .	15,878 8,062 5,685
	24. Treves . .	131·13	446,796	3407	1 Treves . . . 2 Saarbrück . . .	14,941 7,498
	55. Aix-la-Chapelle	75·65	371,489	4911	1 Aix-la Chapelle . . 2 Erepen . . . . 3 Düren . . . 4 Burtscheid . . .	38,878 11,678 7,439 6,467
	Total . .	487·14	2,473,723	5078	27 towns, with above 5000 inhabitants.	
The whole Monarchy, without Neufchâtel		5077·41	14,098,125	2776	129 with above 5000 civil inhabitants, viz 8 towns with above 30,000 inhab. 12 between 15,000 and 30,000 20 between 10,000 and 15,000 89 between 5,000 and 10,000	
The Principality of Neufchâtel ..		13·95	56,073	4020	1 La Chaux de Fonds . 2 Locle . . . . 3 Valangin . . . Neufchâtel . . . Val de Travers . .	7,874 6,[illegible]06 6,104 6,001 5,079
Sum Total		5091·36	14,154,198	2668		

The Constitution is an unlimited monarchy, hereditary in the male and female line. Prussia had formerly a representative body called the Estates. In process of time the power of the crown increased, and the government was carried on without the intervention of the estates, which fell into disuse. After the conclusion of the wars of the Revolution, the late king Frederic William III. issued, on the 22nd of May, 1815, an ordinance, which promised that each province should have its own estates; and it was understood that at a subsequent time there should be a general representation of the whole kingdom. Accordingly, in July, 1823, a law was promulgated for the institution of provincial estates, which have been since regularly convoked in all the provinces; but the king did not take any steps towards the institution of a general national representation. On the accession of the present king Frederic William IV., it seems to have been expected that he would fulfil what were understood to have been his father's intentions, and while he was at Königsberg, in Sept. 1840, to receive the homage of the estates of the province of Prussia, that assembly resolved, by a great majority, to insert in their address to his majesty a clause reminding him of the ordinance of 22nd May, 1815, and requesting him to fulfil the promise of a national representation. The king, however, in his answer declares, that his father, soon after the issuing of that ordinance, was induced by the events that took place in other countries, to take into serious consideration the meaning that might be given to his words; that reflecting on the sacred duties of the royal office confided to him by God, he resolved to fulfil his promises, but keeping aloof from the prevalent notion of a general national representation, he should follow, for the real good of the people committed to his care, and with the sincerest conviction, the most natural course, and which, conformably to historical tradition, was the best adapted to the German national character. The result was the establishment of provincial and district assemblies in all parts of the monarchy.

Prussia as a member of the German Confederation, is the second in rank; its contingent to the army is 79,234 men, viz. 58,357 infantry of the line, 3071 light infantry, 11,319 cavalry, 5075 artillery and train with 100 pieces of cannon, 792 pioneers and pontoneers. This contingent, which forms the 4th, 5th, and 6th corps of the army, is for the German provinces; Posen and Prussia being no part of the Confederation. It contributes 2000 florins per annum to the expenses of the Diet; and in the full council has, like the other kings, four votes.

History.—The history of Prussia is brought down to the latter end of the eighteenth century, in the articles **Brandenburg** and **Frederic William** the Great Elector, and his successors, to the end of the reign of Frederic William II. His son Frederic William III. ascended the throne on the 16th of November, 1797, and immediately commenced a general reform in the administration, which was very much needed. In the war of the European powers against France, he maintained a neutrality as stipulated in the treaty of Basle, in 1795, and profited by this season of peace to promote the prosperity of the people, and especially to introduce economy into the public expenditure. Peace being concluded at Luneville, in 1801, by which the left bank of the Rhine was ceded to France, Prussia obtained by the decision of the diet of the Empire in 1803 an accession of territory of nearly 4000 English square miles, with above 400,000 inhabitants. In the war of the third coalition against France, which broke out in 1805, Prussia still preserved its neutrality; but the unexpected march of a French and Bavarian army through part of the Prussian territory, and a visit of the emperor Alexander to Berlin, induced the king secretly to join the coalition against France, on the 8th of November, 1805, upon certain conditions. After the battle of Austerlitz, peace was concluded between Austria and France. A few days before, on the 15th of December, 1805, the Prussian ambassador, Count Haugwitz, concluded a preliminary convention between Prussia and France, by which Prussia ceded Anspach to Bavaria, and Cleves and Neufchâtel to France, which made over the electorate of Hanover to Prussia, and Prussia in fact took possession of that country. This led to a declaration of war by England against Prussia. Various negotiations followed, which ended in a war between Prussia, in alliance with Saxony, and France. Hostilities began on the 9th of October, on the Saale, and on the following day the advanced guard of the Prussian army was repulsed at Saalfield, on which occasion the brave Prince Louis of Prussia was killed. The battles of Jena and Auerstadt, on the 14th October, decided the fate of the Prussian army. The most important fortresses between the Weser and the Elbe surrendered in rapid succession, and Napoleon entered Berlin on the 27th of October. Frederic William retired to Memel, collected a new army, and, together with his ally the emperor of Russia, marched to oppose the advance of the enemy in East Prussia. The battles of Eylau and Friedland led to the peace of Tilsit, 9th July, 1807, by which the king lost half of his dominions, and the French troops continued to occupy the other half. The French did not evacuate Berlin till December, 1808, so that the king could not return to his capital till the end of 1809. Frederic William now laboured with incessant zeal and firmness to heal the wounds which war had inflicted, and to give an entirely new form to the internal administration. The army was reduced to 42,000 men.

In December, 1808, accompanied by his queen, he went to St. Petersburg to confirm his alliance with the emperor Alexander. After a stay of some weeks, he returned to Königsberg, and on the 23rd December, 1809, made his entry into Berlin. But the joy of the king and of the people was damped by the unexpected death of the queen Louisa, on the 19th July, 1810. On the 24th February, 1812, he concluded an offensive alliance with France, and when war broke out between Russia and France, in June, 1812, he sent 30,000 men to join the 10th French corps under Marshal Macdonald, which was employed in the siege of Riga. On the rapid retreat of the French from Russia, the Prussian corps was likewise obliged to retire, but General York, who commanded it, concluded a convention with the Russian general Diebitsch, by which the Prussian corps was declared neutral and separated from the French army. The Prussian people now began to entertain hopes of seeing their country delivered from the yoke under which it had so long suffered, when the king called the nation to arms. The enthusiasm with which this call was answered enabled the king to bring into the field, in 1813, a numerous and well-disciplined army. The campaign of 1813, the advance of the allies to Paris, the capture of that city in March, 1814, the deposition of Napoleon, his removal to the island of Elba, and the restoration of the Bourbons, followed in rapid succession. After the conclusion of the peace of Paris, the king of Prussia visited London in company with the emperor Alexander, in June, 1814, and he afterwards attended at the congress at Vienna. The return of Napoleon from Elba in 1815 led to a new alliance between Prussia, Austria, Russia, and England, who declared war against him. The battle of Waterloo led to the general peace of Europe, which has not since been interrupted. Frederic William continued till his death, on the 7th June, 1840, to devote all his attention to improve the manufactures, commerce, and administration of his dominions: the most important transaction of his reign was the conclusion of the commercial league of which we have already spoken.

PRUSSIA, properly so called, formerly designated by the name of the Kingdom of Prussia, and afterwards divided into the two provinces of East and West Prussia, now forms only one province, which is called the Province of Prussia. It is situated between 52° 54′ and 55° 53′ N. lat. and between 16° 42′ and 22° 45′ E. long. It is bounded on the north by the Baltic, which washes the coast for about 270 miles, on the east by Russia, on the south by the kingdom of Poland and the province of Posen, and on the west by Brandenburg and Pomerania. Its area is 24,780 English square miles, of which 800 are water, and the population is 2,152,873. The climate is temperate and healthy, though very cold in winter, very changeable on the coast, and generally rather damp. The face of the country is level, broken here and there by low ranges of hills. The forests which cover the sandy plains are estimated at two millions of acres. The principal rivers are the Vistula, the Pregel, and the Memel, or Niemen. There are some hundreds of small lakes, namely, 300 in East and 150 in West Prussia; but no large ones, unless we reckon as such the two Haffs, which communicate with the sea only by canals, and have fresh water. [Curisches Haff; Frisches Haff.] Of the smaller ones, M. Preuss names 34 of various sizes, from 5 to 10 or 15 square miles in extent; the two largest are the Mauer lake, 40 square miles, and the Spirding lake, 70 square miles in extent. With regard to the natural productions, the province produces corn, pulse, flax of excellent quality, hemp, tobacco, hops, madder, potatoes, and timber. There are good breeds of the usual domestic animals, abundance both of fresh-water and sea fish, and bees. The mineral kingdom is very poor; iron however, in various forms, is abundant, and that singular production amber is far more plentiful in this province than in any other part of the world. [Amber.] We extract a few particulars from the journey of Messrs. A. von Humboldt, Ehrenberg, and Rose, performed in the year 1829. 'Formerly the collection of amber was under the direction of persons appointed by the government. As much the larger portion is cast up by the sea, and it is therefore easy for the inhabitants of the coast, especially fishermen, to collect it on their own account, they are subject to very annoying restrictions; they cannot enjoy an aquatic excursion without subjecting themselves to a strict search by the officers appointed for the purpose; they can put to sea from certain places only, and if they are found elsewhere, they are liable to be sent to Königsberg or Fischhausen, which, even if they should be found innocent, causes a loss of one or more days. These considerations induced the government of Königsberg, in 1809, to propose to the inhabitants to farm the amber, but the negotiation failing, the right of collecting amber was farmed in 1811 to a Mr. Douglas for 10,000 dollars per annum. Mr. Douglas showed our travellers his warehouse, which, on account of the inflammable quality of the amber, is made fire-proof and closed with massy iron doors. There were at that time 150,000 pounds in the warehouse. This was a larger stock than usual, because the demand from Constantinople, which is the chief market, was much diminished, partly by the wars in which the Porte was engaged, partly by the ordinances of the Sultan to restrict luxury. Mr. Douglas had farmed only the collection from Memel to the territory of Danzig; that which is collected about Danzig is farmed by the city itself. It is remarkable that the quantity of amber collected annually has always remained the same, as appears on examining the accounts from 1531 to 1811.' The manufactures of the province are confined to the towns, of which the principal are Danzig, Elbing, and Königsberg. The commerce of the province has greatly declined in comparison with its once flourishing state, as the many great warehouses that stand empty in all the ports afford a melancholy proof. The rigorous prohibitory system of Russia is the chief if not the only cause of this decline.

After the Goths left the shores of the Baltic, they were succeeded by different Sclavonian tribes. Conrad, duke of Masovia, being unable to defend his country against those mercenaries, called to his assistance the Teutonic knights, to whom he assigned, in 1230, a tract of land on the Vistula, where they built Thorn and Culm. The power of the Order gradually increased; their territory became very rich and flourishing; but the heavy war-taxes and the prodigal magnificence of the knights caused the nobles and the great towns to put themselves under the protection of Poland, and, by a treaty concluded at Thorn in 1466, West Prussia was ceded to Poland, retaining however its own constitution. The German empire, to which the territory of the Order was considered to belong, refused to recognise the treaty of Thorn, and the knights, who retained possession of East Prussia, refused to do homage to the king of Poland, and chose Albert of Brandenburg, son of the margrave Frederic the Elder, of Anspach and Baireuth, for their grand-master, hoping by the help of his house to be able to throw off their vassalage to Poland. But the German empire did nothing, and on the peace of 1525 the Prussian territory of the Order was accepted by the prince for himself and for his own and his brother's male descendants as a fief dependent on Poland, under the title of a grand-duchy. Albert being a Protestant, the Reformation spread over the whole province.

(A. C. Preuss, *Beschreibung von Preussen*, 8vo., 1835; Blumenbach, *Gemälde der Preussischen Monarchie*, 8vo., 1835; Dieterici, *Statistische Uebersicht der wichtigsten Gegenstände des Verkehrs und Verbrauchs im Preussischen Staate, &c.*, 8vo., 1838; J. G. Hoffmann, *Die Lehre von den Steuern*, 8vo., 1840; J. C. Müller, *Geographisches Wörterbuch des Preussischen Staates*, 4 vols. 8vo., 1836; J. W. Heidemann, *Topographisch-Statistisches Wörterbuch der Preussischen Monarchie*, 2 vols. 8vo., 1836; Stein; Hörschelmann; Cannabich, &c.)

PRUSSIAN BLUE. [Blue.]

PRUSSIC ACID. [Hydrocyanic Acid.]

PRUTENIC TABLES. [Reinhold, Erasmus.]

PRUTH, a large navigable river in the Carpathian mountains, in the circle of Stanislawow. It flows for about 30 miles to the north, and then to the east through the Buckowina into Moldavia. From the point at which it leaves the Buckowina, it has formed for the whole remainder of its course, since the peace concluded at Bucharest in 1812, the boundary between Russian and Turkish Moldavia. After a course of about 500 miles it falls into the Danube below Galacz. It is remarkable in history for the narrow escape of Peter the Great in 1711, who was here completely surrounded by the Turks and Tartars near Falezyn. He was happily extricated from his dangerous situation by the address of his consort Catherine I., who, seconded by field-marshal Scheremetoff, made proposals of peace to the grand-vizir, supported, it is said, by powerful arguments in the shape of presents of money and jewels. Peace was concluded on the 23rd of July, 1711, by which Peter obtained his own deliverance and that of his army by the cession of Azoff and some other places.

The Pruth is the Porata (Πόρατα) of Herodotus (iv. 48).

PRYNNE, WILLIAM, an eminent compiler of records, and a distinguished political character in the reign of Charles I. and during the Commonwealth, was born in the year 1600, at Swainswick near Bath, and received his early education in the grammar-school of that city. He became a commoner of Oriel in 1616, and took his bachelor's degree at Oxford in 1620. Soon after taking his degree, he removed to Lincoln's Inn, in which Society he was called to the bar, and subsequently became bencher and reader. His name scarcely appears in the Law Reports of his time, and he never practised at the bar to any considerable extent. He applied himself much to the study of controversial divinity, and became a devoted follower of the well known Puritan divine Dr. John Preston, who was at that time lecturer at Lincoln's Inn. In accordance with the doctrines of the Puritans respecting church government, he published, soon after he came to Lincoln's Inn, several tracts against Arminianism and prelatical jurisdiction, by which, as well as by promoting and encouraging motions in the superior courts for prohibitions to the High Commission Court, he greatly exasperated Archbishop Laud and the clergy against him. In the year 1632 he published a virulent pamphlet called 'Histrio-Mastrix, or a Scourge for Stage-Players,' in which he denounced in coarse and scurrilous language the prevailing fashion of the day for masques, interludes, and other similar entertainments. Amusements of this kind being the favourite recreation of the court (the queen herself having performed in a Pastoral at Somerset-house), Prynne's book gave great offence, and the attorney-general prosecuted him for it in the Star-Chamber. The court fined him 3000*l.*, ordered him to be expelled from the university of Oxford and the Society of Lincoln's Inn, and degraded from the bar, to be set twice on the pillory, and to lose both his ears; to have his book burned by the common hangman, and to be imprisoned for life. In conformity with this sentence, he was formally degraded in the university of Oxford, in April, 1634, and his named erased from the lists. Three years afterwards, while imprisoned in the Tower under the above sentence, he published another pamphlet, entitled 'News from Ipswich,' reflecting severely upon the hierarchy generally, and upon Laud and several of the bishops in particular. For this publication he was again prosecuted in the Star-Chamber, and sentenced to pay a fine of 5000*l.*, to be set on the pillory, to be branded on both cheeks with the letters S. and L. (Seditious Libeller), to lose the remainder of his ears, and to be closely imprisoned for life in Caernarvon Castle. These outrageous sentences were rigidly executed; and the usual consequence of undue severity appeared in the popular sympathy and party spirit which it excited. The Puritan friends of Prynne flocked to Caernarvon Castle in such numbers, that it was thought necessary to change the scene of his confinement; and after he had been at Caernarvon about ten weeks, he was illegally removed by a warrant from the lords of the council to the castle of Mont Orgueil in the island of Jersey. Here he remained until the beginning of the Long Parliament in 1641, when, upon his petition to the House of Commons, he was released by a warrant from the Speaker, and resolutions were passed declaring both the sentences against him in the Star-Chamber to be contrary to law. Clarendon and Anthony Wood describe the extraordinary demonstrations of popular feeling in his favour on his landing at Southampton and on his journey to London. (*History of the Rebellion*, vol. i., p. 199; *Athenæ Oxonienses*, vol. iii., p. 848.) Soon afterwards he was returned as a member of parliament for Newport in Cornwall, and about the same time was made a bencher at Lincoln's Inn. In 1643 he was employed with Clement Walker by the parliament to conduct the prosecution of Colonel Fiennes for cowardice in surrendering the city of Bristol, and seems to have been busily and cordially engaged in the proceedings of the Commons at that eventful time. Serjeant Hyde having been dismissed from his office of recorder of Bath, in consequence of the ordinances of parliament passed in September and October, 1647, Prynne was elected recorder by a considerable majority of the corporation. He took no part in the violent proceedings of the later years of the Long Parliament; and immediately before the king's trial he was ordered into the custody of the serjeant-at-arms for 'denying the supremacy of parliament' in a pamphlet entitled 'The Memento.' (Rushworth's *Collections*, vol. ii., p. 1389.) On the 6th of December he was arrested by the army, and, together with many of his party, ejected from the House of Commons. From this time he became a bitter enemy of Cromwell and the army party; and in consequence of his writings against them, was again imprisoned for several years at Dunster Castle in Somersetshire and Pendennis Castle in Cornwall. Being expressly disabled by parliament 'to officiate or be in any office concerning the administration of justice within the Commonwealth,' he was, in September, 1652, discharged from his office of recorder of Bath; to which however he was again elected shortly after the Restoration. (*Council Book of the Corporation of Bath.*) In the early part of the year 1660, having returned to his seat in the House of Commons as an excluded member, he is said, in a letter to General Monk (Wimwood's *Memorials*, vol. iii.), to have 'exceedingly asserted the king's right,' but with so much of his characteristic bitterness and imprudence, that Monk sent for him and admonished him to be quiet. Upon the dissolution of the parliament, in March, 1660, he was elected to serve in this new parliament for the city of Bath.

Soon after the Restoration he was appointed keeper of the records in the Tower, an office for which his habits of study peculiarly fitted him, and which furnished him with the opportunity of compiling his laborious and useful collections respecting constitutional and parliamentary history. After this period, his pragmatical disposition again brought him into difficulty by the publication of a pamphlet against the proposal bill for regulating corporations. This paper, being considered by the House of Commons to be a seditious libel, he was reprimanded by the Speaker, and threatened with expulsion and prosecution; but upon his making a full confession and recantation, no proceedings were taken against him. He died in Lincoln's Inn, in October, 1669.

Prynne was a most laborious and voluminous writer. A catalogue of his works (which consist of nearly 200 volumes) is given, after an account of his life, in Wood's *Athenæ*, vol. iii., p. 844, edit. Bliss. They are justly characterised by Wood as displaying 'great industry, but little judgment.' The most useful among them are his 'Calendar of Parliamentary Writs,' and his 'Records.' The latter work, consisting of 3 vols. in folio, professed to illustrate and prove the supremacy of the kings of England in all ecclesiastical affairs within the realm, by records taken from the earliest periods of English history to the reign of Elizabeth, but the author did not live to carry his design farther than the reign of Henry III.

PRY'TANIS (Πρύτανις), the name of the chief magistrate in many of the Grecian states. In some states the Prytanis had the superintendence of all matters relating to religion, thus corresponding to the king archon at Athens. (Compare Aristot., *Polit.*, vi. 5.) We read of this office in Corinth, Corcyra, Miletus, Tenedos, Pergamos, Cos, Rhodes, &c. (Wachsmuth, *Hellen. Alterth.*, i., p. 194.)

At Athens, the name of Prytanes (πρυτάνεις) was given to the members of the senate of five hundred, who acted as presidents of the senate and of the assemblies of the people. The senate of five hundred was divided into ten sections of fifty each, who were chosen respectively from the ten tribes into which the Athenian people was divided. Each tribe presided in turn during 35 or 36 days, as the case might be, so as to complete the lunar year of 354 days (12×29½). Their period of office was called a prytany (πρυτανεία). As however fifty was too large a number to conduct business conveniently, every fifty was divided into five bodies of ten each, who presided for seven days over the rest, and were therefore called proëdri (πρόεδροι); and from these proëdri an ἐπιστάτης was chosen for one day to preside as chairman in the senate and the assembly of the people; during his day of office he was entrusted with the keys of the treasury and archive office, and with the state seal.

The prytanes had a building to hold their meetings in, where they were entertained at the public expense during their prytany. This building was called the Prytaneion (πρυτανεῖον), and was used for a variety of purposes. (Hermann, *Political Antiquities of Greece*, § 127.)

PRZEMYSL is a circle in the Austrian kingdom of Galicia, about 2000 square miles in extent, with a population of 240,000 inhabitants, of whom about 14,000 are Jews. The surface is level: the country contains extensive forests, and is watered by the Save, or San, and some smaller rivers: the soil is fertile, and produces corn, hemp, flax, and potatoes: the breeding of cattle is carried on to a great extent. Next to agriculture, the chief employment of the inhabitants is linen-weaving.

PRZEMYSL, the capital of the circle, situated in 49° 46′ N. lat. and 23° E. long., is an old and tolerably well built town on the right bank of the Save, over which there is a handsome bridge 500 feet long. It is surrounded with a rampart, and on a neighbouring eminence are the remains of an antient castle. There are in the town two cathedrals, 14 Roman Catholic and Greek United churches, a convent of Benedictine nuns, a gymnasium, and several schools. Both a Greek United bishop and a Roman Catholic bishop reside here, the latter being under the archbishop of Limberg. The inhabitants, in number 7800, manufacture leather, linen, and wooden-ware, in which they carry on a considerable trade.

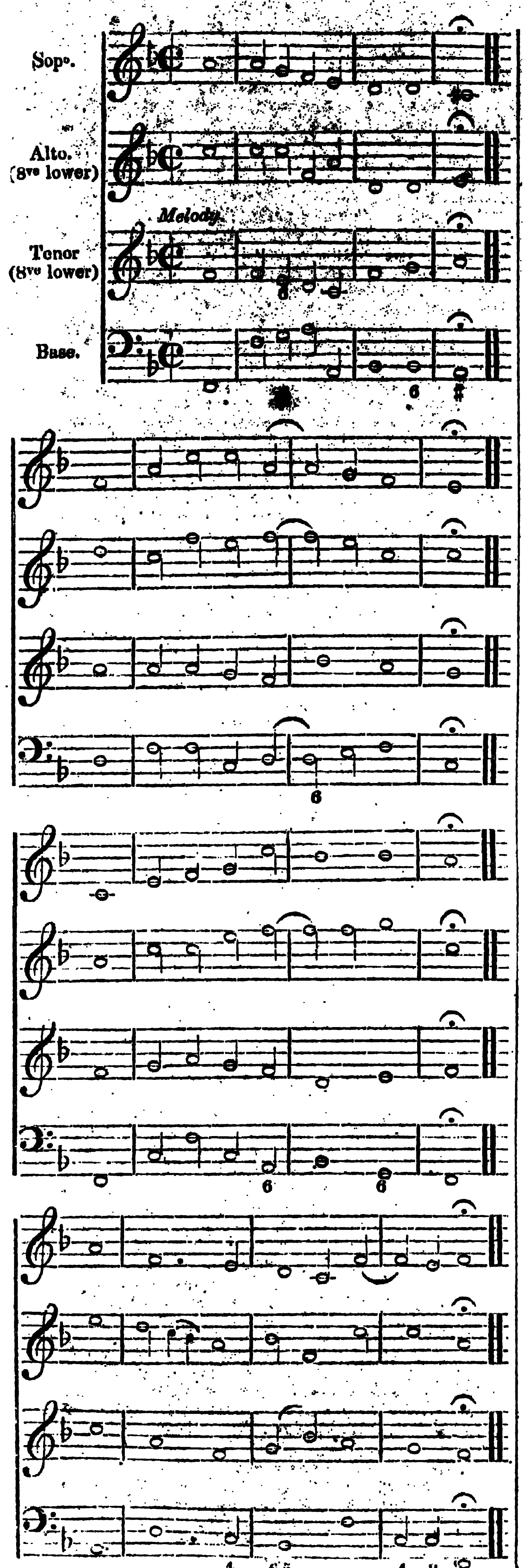
PSALMANAZAR, GEORGE, was born about 1679. All that we know of his early history is from his own memoirs, which were published after his death, but they do not tell us his true name nor that of his native country, though it is generally believed that he was a native of the south of France. (*Memoirs of ...., commonly known by the name of George Psalmanazar, a reputed native of Formosa, written by himself*, London, 1765.) He was in his youth a wandering adventurer. Sometimes he gave himself out for a Japanese, and at others for a native of the island of Formosa: at one time professing to be a convert to Christianity, and at others to be still a heathen. He travelled over several parts of Europe, France, Germany, and the Netherlands; was a soldier, a beggar, a menial, a preceptor, a man of all trades, and came at last to England, where he continued for several years to act the part of an impostor, and published a fabulous account of the island of Formosa, which imposed upon the credulity of the public. His natural abilities and a certain degree of information gained him several influential friends. At last, when about thirty-two years of age, a moral change took place in him; he grew ashamed of his dishonourable courses, became open to religious conviction, and determined to reform. He applied himself intensely to study, and after a time became engaged in literary pursuits, by which he earned an honest subsistence and considerable reputation during the rest of his life. He died in London, in 1753. He wrote, for the large work styled the 'Universal History,' most of the parts concerning antient history, except that of Rome, and his writings met with great success. He also wrote a volume of Essays on several scriptural subjects, a version of the Psalms, besides his own memoirs already mentioned. He also wrote, for the 'Complete System of Geography,' 1747, an article on the island of Formosa, founded upon authentic information, as a reparation for the stories which he had palmed upon the public in his former account. Psalmanazar is the name that he had assumed when he began his wandering life, and which he retained till his death.

PSALMODY, in its widest sense, signifies the Psalms of David set to music and sung. But from the early part of the sixteenth century the term has been applied only to metrical versions of the Psalms to which short grave airs are either set or adapted.

The practice of psalm-singing may be traced to a very remote date, but we need not refer to any period anterior to that of our Saviour. In St. Matthew's and St. Mark's gospels (xxvi. 30; xix. 26), we find that, after the last supper, Christ and his disciples 'Sung an hymn' ('*or psalm*,' says the marginal note), previously to their going 'out into the Mount of Olives.' St. Paul exhorts the Ephesians (v. 19) to sing 'psalms and spiritual songs;' and St. James (v. 13) recommends those who are 'merry' to do the like. The corroborative passage in the letter of the younger Pliny to Trajan (*Ep.*, x. 97) stating that the Christians sang hymns to their Christ before daybreak, is well known. The bishops Flavianus and Diodorus ordained that the Psalms of David should be sung by the choir, in the manner of the antiphons. [ANTIPHONY.] Among the inferior orders of clergy in the church of Rome were the Psalmistæ, whose first institution appears to have been at the commencement of the fourth century. It is believed that this order was established for the purpose of encouraging and regulating the antient psalmody; for, says Bingham, 'from the first and apostolical age, singing was always a part of divine service, in which the whole body of the church joined.' (i. 295 *et seq.*) The service of the antient church usually began with psalmody, according to St. Jerome. (Hieron., *Ep.* 22 'Ad Eustach.') It was also the exercise and recreation of the Eastern churches in their nocturnal vigils; and, indeed, at all times in the church, St. Austin remarks, was psalmody used to fill up vacant intervals. (Aug., *Ep.* 119, 'Ad Januar.')

By degrees the greater part of the psalm-tune was surrendered to a single voice, the congregation joining only at the close. This led to a more scientific and perhaps a more refined mode of singing, requiring superior knowledge; and thus, the body of the people becoming incapable of taking a share of the performance, the service was left in the hands of professed musicians. This was encouraged by the church of Rome, during her long dominion, because it still farther divided the clergy and laity: but Huss, and afterwards Luther and Calvin, restored to the people their share in the divine service, furnishing them at the same time with the means of performing it in a manner agreeable to themselves, and conformably to what they conceived to be the true principles of public worship. With this view the Psalms were turned into metre, tunes were composed or adapted, and the practice of psalmody soon became a marked distinction of those who departed from the church of Rome. Luther however was friendly to harmony, or music in parts; the severe Calvin, on the contrary, sternly refused to admit anything but simple unaccompanied melody. The design of the reformers was seconded by Clement Marot, who translated the first fifty Psalms into French verse. [MAROT.] These, adapted to popular airs, became exceedingly fashionable, and the length to which the new amusement of singing sacred songs was carried by the monarch of France and his courtiers, is fully described by Bayle (in a note on MAROT), and after him by Warton (*Hist. of Poet.*, sect. xlv.), as well as others. Theodore Beza, by his version of those Psalms which Marot left untouched, completed the hundred and fifty. [BEZA.] Most of the melodies to these, as used by the first Calvinists, are commonly attributed to Claude Goudimel and Claude Le Jeune, distinguished French composers; but Bayle, on apparently good authority, ascribes them to one Guillaume Franc; while some think that they were chiefly German. It seems almost certain that a few owe their birth to the great reformer himself, of whose musical knowledge undoubted proofs remain; and it is equally clear, for the reason before mentioned, that the *harmonized* tunes of Goudimel and Le Jeune were not admitted into Calvin's places of worship, though probably their melodies were.

At nearly the time that Marot's translation of the Psalms appeared, Sternhold and Hopkins, with several coadjutors, produced an English version, to which were adapted many of the best German and French tunes; and Strype says, 'it is certain that Sternhold composed several at first for his own solace. For he set and sung them to his organ, which music King Edward VI. sometime hearing (for he was a gentleman of the Privy Chamber), was much delighted with them.' (*Historical Memorials*, bk. i., chap. 11.) But if this versifier possessed as little musical as poetical taste, it is fortunate for him that his compositions do not remain to demonstrate that he was no less unskilful in one art than in the other. It is however to be presumed that there having been many very able musicians in the service of the youthful Edward, they contributed something in aid of Sternhold's design. But it is now generally supposed that for the majestic melody to which our 100th Psalm is adapted, we are indebted to the genius of Claude Le Jeune. This forms the *taille*, or tenor part, of his 134th Psalm, as printed in the Leyden edition of 1635; and it is necessary to remark that he, as well as others in his time, made a practice of giving the subject, or air, as a kind of *cantus firmus*, to the tenor voice. As an interesting and not commonly known relic, we insert this, substituting the treble for the C clefs. The musical critic will not fail to observe that the rhythm of Le Jeune's melody does not exactly correspond to that adopted in England: and he may perhaps concur in our opinion, that the subject has been better treated by the unknown harmonist in this country than by the French composer.



The first complete collection of psalm tunes for four voices deserving notice was published in 1621, by Thomas Ravenscroft, Mus. Bac., to which Tallis, Morley, Dowland, and all the great masters of the day contributed; the name of John Milton, the father of the poet, also appears there, as the composer of *York* and *Norwich* tunes. The editor supplied many, some of which are still in use; and to his collection all the numerous works of the kind since printed have been much indebted. About the year 1671, John Playford, a good musician and a most useful industrious editor, printed, in 8vo., 'The Whole Book of Psalms in three parts,' in which he has judiciously given the melody to the soprano voice, to which it naturally belongs, and it ever since has retained its place. A few of the tunes in that collection are supposed to have been composed by Playford himself, whom Sir John Hawkins considers as 'the father of modern psalmody.' Subsequently to the last edition of his work, valuable additions were made to the stock of genuine English psalmody, by Dr. Croft, Courteville, Carey, &c., and Handel is the reputed composer of the sweet music to the 104th Psalm, which still continues in our chimes, and as the dirge at the soldier's funeral. Dr. Miller, of Doncaster, about fifty years ago, effected a considerable improvement in psalmody by his 'Psalms of David for the use of Parish Churches,' in which the version of Tate and Brady was employed, and drove Sternhold and Hopkins from many of their strongest positions. The extraordinary success of that work, which made its way into the remotest parts of Great Britain, raised up a host of rivals, and the number of publications and of new tunes has since increased beyond calculation. The popular works of all foreign composers have been made contributory to that love of novelty which carries its influence even into the temples of religion, and every tenth organist has fancied himself qualified and privileged to print a collection for the use of the church or chapel in which he officiated. Hence the music which had become almost a part of our Liturgy is falling into desuetude, and modern hymns—not always the most appropriate or the best in point of composition—threaten finally to banish the fine characteristic harmony of our antient psalmody. (Bingham's *Antiq.*; Bayle; Strype; Warton's *Hist. of Poet.*; Mason's *Essay*; Hawkins; Burney; Dr. Vincent *On Psalmody*.)

PSALMS (ψαλμοί, from ψάλλω, *to strike gently*, and so, to play on a stringed instrument) denote generally the poems which form one of the canonical books of the Old Testament. This book is called in Hebrew סֵפֶר תְּהִלִּים (*sepher tehillim*), 'the book of praises.' Many of the Psalms have titles, which, though they are no part of the original, are of great antiquity, and in these titles a Psalm is called מִזְמוֹר (*mizmor*), something pruned, trimmed, or finished off, from זָמַר, *to prune.*

The book of Psalms is often called the 'Psalms of David,' though many of them were not written by him. Ps. xc. for example was written by Moses, and Ps. lxxxv. and cxxxvii. were composed long after the time of David by persons unknown. The authors of the Psalms named in the titles are Moses, David, Solomon, Asaph, Heman, Ethan, Jeduthun, and the sons of Korah. Between the earliest and latest of the Psalms, a period of about one thousand years seems to have intervened.

According to the Masorites, the Psalms are divided into five books, of which the first ends with Ps. xli., the second with Ps. lxxii., the third with Ps. lxxix., the fourth with Ps. cvi., and the fifth with Ps. cl. The first three books end with 'Amen and Amen;' the last two with 'Hallelujah.' This division existed in the time of Jerome, but how long before is uncertain. It is thought to have been made for the purpose of rendering the Psalms in this respect like the Pentateuch. The collecting of the Psalms into one book is generally attributed to Ezra.

The Psalms afford an exemplification of every variety of Hebrew metre, and they are pervaded by the highest poetic feeling. They were designed to be rehearsed in the worship of God with the aid of instrumental music. David appointed the singing of the Psalms by a company of persons, trained for this purpose, in the worship of the tabernacle. (1 *Chron.*, vi. 31; xvi. 4-8.) This practice was continued by Solomon in his Temple (2 *Chron.*, v. 11-13), and, after the interruption occasioned by the Captivity, it was renewed by Ezra. (*Ezra*, iii. 10, 11.) The New Testament fur nishes evidence that Psalmody formed, in the time of Christ and his Apostles, a part of the worship of God, and the Christian church has in all ages followed this example. The book of Psalms obtained extraordinary attention among the early Christians. Theodoret, who wrote in the first half of the fifth century, says (*Preface to the Psalms*), that while most men paid little or no attention to the rest of the Scriptures, they were so familiar with the Psalms, that in their houses, in the streets, and in the highways, they enjoyed profit and delight by the singing of these divine odes. The following passage is part of a beautiful eulogy pronounced upon the Psalms by Hooker; 'What is there necessary for man to know which the Psalms are not able to teach? They are to beginners an easy and familiar introduction, a mighty augmentation of all virtue and knowledge in such as are entered before, a strong confirmation to the most perfect amongst others. Heroical magnanimity, exquisite justice, grave moderation, exact wisdom, repentance unfeigned, unwearied patience, the mysteries of God, the sufferings of Christ, the terrors of wrath, the comforts of grace, the works of Providence over this world, and the promised joys of that world which is to come, all good necessarily to be either known or done or had, this one celestial fountain yieldeth.' (*Ecclesiastical Polity*, v. 37.)

The canonical authority of the book of Psalms has never been disputed.

(Patrick's *Paraphrase*; Rosenmüller's *Prolegomena* and *Scholia to the Psalms*; Horne's *Introduction*.)

PSALTERY, an antient musical instrument of the harp kind, in use among the Jews, and supposed by Blanchinus to have been the נבל, *nebel* (whence ναβλα and *nablum*), mentioned in several of the Psalms. Whether this instrument was square or triangular, and played on by the finger, or struck by a plectrum, seems doubtful; the probability is that it took many forms, and was acted on both ways. Blanchinus makes it square, Luscinius triangular. According to Mersenne, and after him Kircher, the Psalterion, as they denominate this instrument, adopting the Greek term, was in shape a trapezium, and similar to that which is still in use under the name of dulcimer. [DULCIMER.]

PSAMMO'BIA. [PSAMMOCOLA.]

PSAMMO'COLA, M. de Blainville's name for a genus of conchifers (*Psammobia* and *Psammotæa*, Lam.) belonging to Lamarck's family *Nymphacea*. *Animal ?*

Shell oval, elongated, regular, gaping but little, equivalve, subinequilateral; umbones well indicated and a little inclined forwards; often a well marked angle on the posterior or longest side; hinge somewhat incomplete; one or two small cardinal teeth in each valve; ligament external, very convex; two very distinct muscular impressions, united by a narrow pallial impression deeply excavated backwards and prolonged rather strongly beyond.

M. de Blainville proposes the following divisions of this group:—

1. Capsoïds.

Shell hardly gaping, striated from the summit to the base, with two intrant, oblique, divergent teeth in each valve, but largest on the left valve.

Example, *Psammocola rugosa*.

2. Psammobiæ.

Shell more gaping, striated longitudinally; teeth of the hinge much more effaced.

Example, *Psammobia virgata*.

3. Psammotææ.

Shell of the same form; a single cardinal tooth in each valve or in one only.

Example, *Psammotæa violacea*.

Psammobiæ have been found in most seas and on sandy bottoms at depths varying from 0 to 13 fathoms. [PYLORIDEA.]

PSAMMO'DROMUS, a genus of Saurians belonging to the *Pristidactyl Cœlodonts* of MM. Duméril and Bibron. [PRISTIDACTYLS.] Type, *Psammodromus Hispanicus*, Fitzing.

PSAMMOSAURUS, [SCINK.]

PSARIS. [MUSCICAPIDÆ, vol. xvi., p. 12.]

PSARISO'MUS. [MUSCICAPIDÆ, vol. xvi., p. 12.]

PSE'LAPHUS, according to Herbst, a genus of Coleopterous insects, but now regarded as a family, to which the name *Pselaphidæ* is applied. The *Pselaphi* are very minute insects and most remarkable in their structure. By some entomologists they are arranged with the *Brachelytra*, owing to their having the wing-cases short and truncated; and by others they are placed in the section *Trimera*, their tarsi having but three joints: in the classification of Latreille they constitute the last family of Coleopterous insects, being placed at the end of the Trimera.

Scarcely any of the known *Pselaphi* exceed one-twelfth of an inch in length, and the greater portion of them are under that size: they prey upon other insects still smaller than themselves, and are found under stones and amongst herbage, especially in damp situations: some species are found under the bark of trees and in putrid wood, and the species of one of the genera are found in ants' nests (the genus *Claviger*). They are often collected during the winter months by shaking the moss from the roots of trees, or from old walls, over a piece of white paper or cloth. They are probably found in all parts of the world. The principal characters of the group are as follows:—

Head moderately large, exserted, and most commonly of a triangular form, being broad at the base and attenuated in front: the eyes moderately prominent, sometimes wanting; palpi usually large and generally four-jointed: antennæ usually eleven-jointed, sometimes with six joints, and in one genus apparently having but one large joint, generally equal to about half the length of the insect, and increasing in thickness from the base to the apex. Thorax usually not much broader than the head, sometimes nearly cylindrical, but most commonly dilated in the middle: elytra broad, much shorter than the abdomen, and truncated behind, destitute of striæ, if we except one on each elytron near the suture, and an abbreviated stria at the base about midway between the suture and the outer margin—these are almost constant. Abdomen broad, obtusely terminated, and without appendages as observed in the Brachelytra; usually four or five joints are visible beyond the elytra: legs rather long; tibiæ curved; tarsi three-jointed, the basal joint small, and the terminal joint furnished either with one or two simple claws.

The *Pselaphidæ* are composed of the following thirteen genera, which may be most briefly characterised by throwing them into a tabular form, as in M. Aubé's Monograph, published in Guerin's 'Magasin de Zoologie' for the year 1834.

Section 1. Antennæ two-jointed.

Division 1. Tarsi with two claws.

1. A. with the claws unequal.

1. *Metopias.*—Thorax cordiform; antennæ with the basal joint almost as long as the others taken together.

1. B. with the claws equal.

2. *Tyrus.*—Palpi with the three basal joints obconical; thorax nearly spherical; antennæ with the three terminal joints very slightly incrassated.

3. *Chennium.*—Palpi with the second joint broader than the others, and of a spherical form; antennæ moniliform; thorax broad behind.

4. *Ctenistes.*—Palpi with the joints large and produced posteriorly into a spinous process.

Division 2. Tarsi with a single claw.

5. *Pselaphus.*—Body slightly elongated; elytra and abdomen somewhat depressed; the terminal joint of the palpi much elongated and clavate.

6. *Bryaxis.*—Body short, slightly convex; terminal joint of the palpi conical and somewhat dilated externally; thorax dilated in the middle and having three foveæ.

7. *Tychus.*—Body short and convex; the terminal joint of the palpi hatchet-shaped; basal joint of the antennæ large, the fifth joint dilated in the male; thorax without foveæ.

8. *Bythinus.*—Body very convex; the terminal joint of the palpi securiform; two basal joints of the antennæ large, the second often dilated in the males.

Those species in which the second joint of the antennæ is not dilated in the male sex, and does not exceed the basal joint in size, form the genus *Arcopagus* of Leach.

9. *Trimium.*—Body comparatively narrow and elongated; terminal joint of the palpi conical (or nearly so) and dilated on the inner side at the base; and terminated with one very large joint.

10. *Batrisus.*—Body elongated; antennæ inserted in a lateral groove; palpi with the terminal joint acute; thorax with three longitudinal furrows; antennæ rather long and gradually thickened from the base to the apex.

11. *Euplectus.*—Body elongated and subdepressed; terminal joint of the palpi ovate; antennæ short, inserted be-

neath the edge of the forehead and terminating in a large knob.

Section 2. Antennæ six-jointed.

12. *Claviger.*—Head elongated, obtuse in front, and not distinctly separated from the thorax; eyes none; thorax with the sides slightly rounded; body ovate: no furrows or foveæ on either the thorax or the elytra.

Section 3. Antennæ with but one large and elongated joint.

13. *Articerus.*—Head broad and notched in front, attenuated behind; eyes prominent; thorax broadest behind; body ovate.

Examples of most of these genera are found in this country. Of the genus *Metopias* only one species is known; it inhabits Cayenne. The genus *Tyrus* is found in Sweden and Germany, and perhaps in England. Of the genus *Chennium* but one species is known: it is found in the South of France. The curious genus *Claviger* has but recently been discovered in England by Mr. Westwood: it is found in the nest of a species of ant (*Formica flava*). On the Continent it has been long known.

Owing to their remarkable appearance, and the curious forms displayed by the various species, the *Pselephidæ* have been more carefully studied perhaps than any other group of minute insects, and have given rise to several monographs—see the 'Monographia Pselaphidorum et Seydmænidarum Britanniæ,' by H. Denny, Norwich, 1825, 1 vol. 8vo.; 'Monographia Pselaphorum,' H. F. L. Reichenbach, Lipsiæ, 1816, 1 vol. 8vo. P. W. J. Müller has published a monograph on the Pselaphi in the third volume of the 'Magazin der Entomologie, von E. F. Germar.' M. C. Aubé has likewise published an excellent monograph on the same group, which has been quoted in the former part of this article.

PSEUDO-AMEIVA, Fitzinger's name for a genus of the *Pleodontes Strongylures* of MM. Duméril and Bibron, genus *Trachygaster*, Wagl., *Centropyx*, Spix. [Pleodonts.]

PSEUDO-BOA, Schneider's name for a genus of serpents (*Scytale*, Merr.) arranged by Cuvier as a subgenus of *Boa*, and described as having plates not only on the muzzle, but on the cranium, like the *Colubri;* no fossets, a round body, and the head 'd'une venue avec le tronc,' as in *Tortrix.*

Mr. Swainson makes *Pseudo-boa*, Oppel., the last genus of the family *Hydrophidæ*, or *Water Snakes*, with the following description:—

Head short, enlarged behind, and covered with large plates; back carinated with a longitudinal range of scales, wider than those of the sides.

PSEUDOBDELLA, M. de Blainville's name for a genus of *Hirudinidæ*, or *Leeches.* [Leeches, vol. xiii., p. 383.]

PSEUDOCA'RCINUS, M. Milne Edwards's name for a genus of *Cancerians.*

General form that of many Xanthi [Xanthus]; *carapace* slightly convex, and a little embossed near the front, which is nearly horizontal; latero-anterior borders moderately curved, and armed with more or less projecting teeth; posterior portion of the carapace nearly of the same extent as the anterior, with its lateral borders straight, and directed very obliquely backwards. The basilary joint of the *external antennæ* is very small, the second hardly reaches the front, and the third, which is lodged in the orbital gap, does not fill it, so that the antennary fosset is not completely separated from the orbit; the terminal stem of these appendages, instead of being very short, is more than twice as long as its peduncle. The prelabial space is not canaliculated, as in *Ozia*, the genus which immediately precedes it in the arrangement of M. Milne Edwards, and the external jaw-feet present nothing particular. The first pair of *feet* are remarkable for their size, especially in the male, and have nearly the same form as in *Carpilius*, but are still stronger; the pincers are equally rounded and obtuse at the end; they are unequal and armed with large rounded tubercles, which, on one side (the right generally), are few in number, but of remarkable volume. The succeeding feet are of a fair length, and much resemble those of the first division of *Xanthus*, except that they are narrower, and that their last joint is longer. The abdomen of the male is divided into seven very distinct articulations. (M. E.)

Geographical Distribution of the Genus.—The Indian and Southern Oceans.

M. Milne Edwards divides the genus thus:—

A. Species having the lateral borders of the carapace armed with four or five teeth.

a. Upper surface of the carapace embossed anteriorly.

Example, *Pseudocarcinus Rumphii*, *Cancer Rumphii*, Fabr. (Herbst, t. iii., pl. 49, f. 2.) Length from two to three inches.

Locality.—The Indian Sea.

aa. Carapace smooth, without remarkable embossments on its anterior part.

Example, *Pseudocarcinus ocellatus.* Length about three inches. Colour of the carapace yellowish, with a multitude of circular red spots; pincers black; four last pair of feet banded with red and yellow.

Locality.—Unknown.

B. Species having the latero-anterior borders of the carapace armed with nine or ten spiniform teeth.

Example, *Pseudocarcinus Gigas*, *Cancer Gigas*, Lam. Length about seven inches. Colour yellowish marbled with red; pincers black.

Locality.—The seas of New Holland.

PSEUDOCORYSTES, M. Milne Edwards's name for a genus of brachyurous crustaceans belonging to his tribe of *Corystians*, and bearing much analogy to *Corystes* [Corystes], and especially to *Nautilocorystes.*

General form approximating to *Corystes*, but the feet natatory, as in *Nautilocorystes*; *jaw-feet* differing from those of both.

Carapace nearly oval and fairly convex. *Front* narrow, advanced, and horizontal. Ocular peduncles of moderate size, and the moderate-sized orbits entirely open externally. *Internal antennæ* small, and completely covered above by the front, their stem bent back longitudinally, as in *Corystes.* Disposition of the *external antennæ* essentially the same as in those crustaceans, but the auditory frame placed at their base is very large. *Epistome* not distinguished from the prelabial space, and the *buccal frame*, which is entirely open anteriorly, prolonging itself laterally before the base of the external antennæ, where it terminates by a stout conical tooth, which with that appendage forms the lower wall of the orbit. *External jaw-feet* very wide, second joint very large, but the third small, triangular, and nearly as long as it is wide; their terminal stemlet is extremely short, and is inserted near the summit of the third joint. The *sternal plastron* is nearly of the same form as in *Corystes.* The anterior feet are stout, compressed, and of moderate length. The four succeeding feet are nearly all of the same length and very much compressed; their tarsus is lamellar, wide, and of lanceolate form, especially in the second and fifth pair. The *abdomen* is very narrow, and has only five distinct segments in the male; the third, fourth, and fifth rings are soldered together. (M. E.)

Example, *Pseudocorystes armatus.* Length two inches.

Locality.—Valparaiso.

M. Milne Edwards observes that the crustacean figured by Browne ('Jamaica,' pl. 48, f. 2) under the name of the *Grass-crab* belongs to this genus, and may not differ specifically from *Ps. armatus.*

PSEUDOGRAPSUS. [Grapsus, vol. xi., p. 361.]

PSE'UDOPUS. [Scheltopusik.]

PSEUDO'STOMA. [Muridæ, vol. xv., p. 513.]

PSEUDOZOA'RIA. From the earliest times when systematic views of nature were sought, clouds have overhung the obscure confines of the animal and vegetable kingdoms. We find Aristotle perplexed regarding the animal or vegetable nature of sponge, Trembley and Ellis removing errors regarding the hydræ and celluliferous polypiaria, Lamarck classing Corallina with animals, and Blainville deciding that it is a plant. Much of this difficulty arises from the various definitions which are employed to characterise animal existence. To show irritability of parts, to have the faculty of self-movement, to exhibit sensibility—such or other characters being assumed for animals, we shall always find in some part of the vast series of life some particular beings in which these characters become unrecognisable (though they may exist), or equivocal, even if they do not conduct to erroneous results.

One of the modes by which systematists have eluded a difficulty, which nothing but strict and patient scrutiny can conquer, is by constituting an intermediate order of life, so vaguely characterised as to embrace the doubtful conterminous tribes of the animal and vegetable races. Hence the terms Phytozoa, Zoophyta, Nematozoa, and, according to the same analogy, Lithophyta, Ceratophyta, Calciphyta, to express the stony or horny nature of the animal or vegetable structures, or even to convey some hint of their analogy to mineral aggregations.

Pseudozoaria is a term of the same order proposed by Blainville to include vegetables, many of which have been ranked with the Polypiaria. It is subdivided into two classes: Calciphyta, which are principally composed of the genus Corallina, Linn.; and Nematophyta (also called Namatozoaria), which include Conferva, Oscillatoria, Byssus, &c.

Class I. Calciphyta.

Plantlike, mostly solid, attached, but not by real or penetrating roots. Composed of two substances, the interior more or less fibrous, the exterior cretaceous and porous, and generally subject to discontinuity, whence the whole appears articulated.

Lamouroux calls the group Polypiaria calcifera.

Fam. 1. Corallinæa.

Stem and branches encrusted with a thick porous calcareous substance, discontinuous at intervals, whence the whole is articulated. (This is the genus Corallina, Linn., which Lamarck and Lamouroux have greatly divided.)

Genera.

Cymopolia, Lamouroux.

Articulations moniliform, perforated by distinct circular pores.

Example, Cymopolia barbata. Ellis, 'Corallines,' pl. 25, fig. *c* C. The few species are chiefly West Indian.

Corallina.

Flabelliform, trichotomous, articulations distinct, the upper ones compressed or dilated; pores obscure.

Example, Corallina officinalis. Ellis, 'Corallines,' pl. 24, fig. *a* A. The species occur in various parts of the ocean and of the British coasts.

Jania, Lamouroux.

Divided, like moss, into slender round capillary articulated dichotomous branches.

Example, Jania corniculata. Ellis, 'Corallines,' pl. 24, fig. *d*.

European seas.

Flabellaria, Lamarck. (Halimedea, Lam.)

Flabelliform; branches trichotomous; articulations distinct, flattened

Example, Flabellaria incrassata. Ellis and Solander, pl. 20, fig. *d*. West Indies.

Amphiroa, Lamouroux.

Articulations very distinct, the intervals fibro-cartilaginous. (Some species have verticillate branches, the others are much like Corallina.)

Example, Amphiroa fragillissima. Ellis and Solander, pl 21, fig *d*.

Many of the species are Australasian.

Penicillus, Lamarck. (Nesæa, Lamouroux.)

Composed of capillary radical fibres, a simple stem, and a crown of cylindrical dichotomous articulated branches.

Example, Penicillus phœnix. Ellis and Solander, pl. 25, fig 2.

Most of the species are Australasian.

Galaxaura, Lamouroux.

Articulations tubuliform, cylindrical, soft and cellular within, ramifying dichotomously so as to form a conical tuft, originating in a single membranoso-calcareous articulation. (Included by Lamarck in his genus Dichotomaria.)

Example, Galaxaura rugosa. Ellis and Solander, pl. 22, fig. 3.

The species are chiefly West Indian.

Acetabulum, Lamarck. (Acetabularia, Lamarck.)

Stem simple, filiform, articulated, fixed, supporting an orbicular terminal lamina, which is radiated above and below, and formed of little radiating tubes open at their ends.

Example, Acetabulum mediterraneum, Blainv.; Tubularia acetabulum, Linn. Blainville, 'Actinol.,' tab. 66, fig. 3.

Polyphysa, Lamarck.

Adherent, fixed, composed of a vertical filiform, fistulous, articulated stem, supporting a capitulum of eight or ten oval foliaceous membranous bodies arranged in a radiating manner.

Example, Polyphysa australis, Lam. 'Polyp. flex.,' pl. 8, fig. –

Fam. 2. Fucoidæa.

Stem and branches internally fibrous or membranous, encrusted by a thin calcareous continuous layer, *without articulations* or pores. Substance more gelatinous than in the Corallinæa.

Genera.

Udotea, Lamouroux.

Fibro-cretaceous, flabelliform; stem short, spreading rapidly into a large expansion, lobed or cut at the circumference, and marked on both faces with concentric lines. (Corallina of Linnæus.)

Example, Udotea flabelliformis, Sol. and Ellis, tab. 24. The species are American.

Dichotomaria, Lamarck.

Membrano-cretaceous, lichenoidal, originating in a short simple stem, and terminating in compressed dichotomous ramifications, rounded at the extremity.

Example, Dichotomaria fruticosa. Ellis and Solander, pl. 22, f. 5. The species are chiefly West Indian.

Liagora, Lamouroux.

Subcretaceous, branching. Ramifications ending in soft swollen parts like buds. (Analogous to Fucus, with which one species has been ranked by Gmelin.)

Example, Liagora versicolor, Lamarck. The species are chiefly from the Mediterranean.

Neomeris, Lamouroux.

Elongated, tumid in the middle, attenuated towards and enlarged at the ends, by one of which it is attached. The central axis is membranaceous and fistulous; it is surrounded by a crust composed of crowded small tubular cylinders, and in the upper part small globular tubercles. The whole is enveloped in another thin calcareous crust marked by many small pits in quincunx.

Example, Neomeris dumetosa, Lamouroux, 'Zooph.,' tab. 68, f. 10, 11. South America.

Class 2. Nematophyta, Blainville.

(Syn. Nemazoaria, Gaillon.)

Generally filamentous, gelatinous, green, unattached aquatic bodies.

Concerning these singular objects three opinions have been maintained:—

1. They have been (not all, but most of them) ranked as genuine plants by Linnæus, Lamarck, &c.

2. They have been considered as of a mixed or alternating nature, so that, growing and appearing like plants, they yield seminal parts which are endowed with locomotion (as the ova of sponges) for a short period, and thus appear as animals. Agardh, Fries, and Bory de St. Vincent support views of this nature.

3. They have been described as plant-like agglomerations of animals, originally free and individualised. M. Gaillon, 'Annales des Sciences Naturelles,' &c., has maintained this opinion after exact and curious researches, and many eminent persons have admitted this remarkable doctrine.

M. Gaillon has proposed a classification in conformity with his views, which includes two grand divisions, viz. Monadulées (resembling Monas or polygastric animalcule) and Naviculées (resembling Bacillaria or Navicula). In the former are two families, viz. Endocystées (reproductive globules formed internally) and Ectocystées (reproductive globules formed externally). In the second division are the Diarthrosées (animalcula associated by junction) and Eleuthériées (animalcula associated without junction). The first family includes ordinary Confervæ, &c.; the second, Mucor and Charæ, &c.; the third, Diatomæ, &c.; the fourth, Girodella. This whole subject appears still to need new researches. [ALGÆ; CHARACEÆ.]

PSI'DIUM, one of the Greek names of the pomegranate, which has been applied to a South American genus of plants belonging to the natural family of Myrtaceæ. The genus is characterised by having a calyx with an obovate tube and a 5-fid limb. Petals 5. Stamens numerous. Style filiform. Stigma capitate. Ovary 5-20-celled. Ovules numerous, horizontal, attached to the margin of the placenta. Fruit baccate, covered with the tube of the calyx, and crowned by its lobes, many-seeded. Seeds in the ripe fruit nestling within a pulp. Testa bony. Embryo curved. Cotyledons leafy, very small. Radicle very large. The species are about forty in number, either trees or shrubs. Leaves opposite, quite entire, feather-nerved, not dotted. Peduncles axillary, 1-3-flowered, bibracteated. Flowers white.

Two species are alone much known. These are, P. pomiferum and P. pyriferum, which yield the fruits so well known under the name of Guava. These two natives of South America and of the West Indies have been transferred to the Old World, and are as extensively cultivated in the Indian Archipelago and in India as in the countries where they are indigenous. P. Cattleianum is a species remarkable for the purple colour of its fruit. The Guava, of which the name is derived from the American word Guyaba, is much esteemed in hot countries as a fruit, and comes nearest to the pear, though its odour is not thought agreeable by many. It is also preserved and made into a jelly. The roots, buds, and leaves are astringent, and used as such medicinally. Some of the species are cultivated in hot-houses, but do not ripen their fruits well.

PSILOPO'GON, Boie's name for a genus of *Picidæ* (Wood-peckers).

PSILOSO'MATA, M. de Blainville's name for his third family of his order *Aporobranchiata*, and placed by him at the end of that order and immediately before the order *Polybranchiata*, which contains the genus *Carolina*. [POLYBRANCHIATA.]

The only genus of *Psilosomata* recorded by M. de Blainville is *Phylliröe*.

Generic Character.—Body free, naked, very much compressed, or much higher than it is thick, terminated behind by a sort of vertical fin; cephalo-thorax small, and provided with a pair of natatory appendages, which are triangular, compressed, and simulate a kind of long tentacles or branchiæ; mouth subterminal, of a horse-shoe shape, with a short retractile proboscis; anus on the right side of the body; orifice of the organs of generation unique, on the same side, and more anterior than the anus. Organs of respiration?

Example, *Phyllirhöe Bucephalum*.

Locality.—Discovered in the Mediterranean Sea, by Péron and Lesueur.

PSI'THYRUS (Saint-Fargeau), a genus of Hymenopterous insects belonging to the section *Anthophila* (Latreille) and family *Apidæ*. The insects of this genus so closely resemble the Humble-bees (*Bombus*), that till recently they were by all authors confounded with them. The Psithyri however differ widely from the Humble-bees, inasmuch as they make no nests of their own, neither do they collect food for their young, but, like the cuckoo among birds, they deposit their eggs in the nests of others, and leave their young to be hatched and reared by them. It is the nests of the Humble-bees that they select for this purpose. Mr. Newman considered these facts relating to their economy so important, that he established an order among Hymenopterous insects, to which he gave the name *Apathites* (from α, without, and πάθος, affection), for the reception of the present insects, which, according to him, constitute the genus *Apathus*, and some other genera of bees. The characters of the order *Apathites*, given by the author, are as follows:—larva hatched from an egg, deposited by its parent in the nest of other *Apidæ* at the time when their own eggs are laid; when it hatches, being stronger and larger than the rightful possessor of the cell, it consumes the food provided for its companion, and starves it to death; and in those instances in which fresh supplies of food are daily provided, it continues to receive and appropriate them as its own. Pupa changes in the same situation, in a silken cocoon, spun by the larva. Imago has no apparatus either on the body or legs for collecting honey; in other respects it resembles in structure each of the other orders of *Apidæ*; it enters their nest with perfect familiarity, and seems to be quite unsuspected of intrusion; it collects no pollen or honey, never builds a nest of any kind, nor takes any care of its young, but spends its time among flowers, or hovering about sand-banks in which other bees have fixed their habitations. The genera included in this order are:—Apathus (or *Psithyrus*[*]), *Cœlioxys*, *Melecta*, *Stelis?*, *Epeolus*, *Nomada*, *Hylæus?* (*Entomological Magazine*, vol. ii., p. 404.) The order *Apathites* however is very objectionable in many points of view; it is founded upon the habits of the species; whilst in fact the habits of the individuals composing the very genera placed by the author in his order are in many cases but partially known; the order moreover comprises genera agreeing in no positive points of structure.

The species of the genus *Psithyrus* may be distinguished from those of *Bombus* by the structure of their hinder legs. In *Bombus* the hinder tibia is compressed, smooth, and somewhat concave on the outer side, and is furnished on its edges with a fringe of stiff curved hairs, which serve to retain on the outer side of the shank the pollen collected by the insect to feed its young. The *Psithyri* have the tibia narrower and covered throughout with hair; they have no basket for the purpose of carrying pollen.

Four or five species of *Psithyrus* are found in England, and these are well described by Kirby in his 'Monographia Apum Angliæ.' They are arranged by that author in his genus Apis, section * *, c. 2, which section also includes the true *Bombi*.

Psithyrus rupestris very closely resembles the Red-tailed Humble-bee (*Bombus lapidarius*), but may be distinguished by the dark (almost black) colour of its wings. The *Apis Albinella* of Kirby is no doubt the male of this species.

Ps. campestris is black, has a yellow band on the fore part of the thorax, yellow hair on the scutellum, and a patch of yellow on either side of the abdomen at the apex. *A. Rossiellus* of Kirby is no doubt the male of this species.

P. Barbastellus is black, has the fore and hinder portion, the thorax, and the base of the abdomen yellow; the apex of the abdomen is white.

A. subterraneus and *A. vestalis* of Kirby's monograph also belong to this group.

PSITTA'CIDÆ, PARROTS, an extensive and highly interesting family of birds, remarkable for their beautiful colours, their powerful bill, their fleshy tongue, and their power of imitating the human voice. The articulation of some of the species is so perfect, that when the bird is unseen it is difficult to suppose that the words pronounced do not proceed from the mouth of man.

That several of these birds were known to the antients, both Greek and Roman, we have abundant evidence. Not to weary the reader with quotations, we shall here only refer to Ctesias (*Indic.*, 3; *Phot. Bibl.*, lxxii.); to Aristotle (*Hist. Anim.*, viii., xii.), where he notices the anthropoglott, ψιττακη, as the Indian bird, and refers to its powers of mimicry; to Arrian, who speaks of the σιττακος, and its imitation of the human voice (*Hist. Ind.*, c. xv.); to Plutarch, who alludes to the same quality in his treatise, *De Solertia Animalium* (vol. x., p. 51, ed. Reiske; vol. iv., p. 972, Lat. Paris, 1724); to Ovid (*Amor.* ii. 6); Persius in the Prologue to his *Satires* (line 8); and Martial's delicate flattery (xiv. ep. 73),

> 'Psittacus à vobis aliorum nomina discam
> Hoc didici per me dicere; Cæsar ave.'

These, with the exception of the passage in Ctesias, and many more examples, will be found in the learned treatise by Mr. Vigors, 'On a Group of Psittacidæ known to the Antients' (*Zool. Journ.*, vol. ii.), where he reminds us that the antient writers are unanimous in informing us that the parrots known to their times came exclusively from India. 'We are informed by Ælian,'[*] continues Mr. Vigors, 'that they were the favourite inmates of the palaces of the princes; and were looked up to as objects of sacred reverence by the religious feelings of the people. From thence they were introduced into Europe at the time of the Macedonian conquest; and the specific name of *Alexandri*, applied by modern science to the type of the group, in honour of the first European discoverer of it,'[†] serves to perpetuate the name of a warrior who is said to have valued the conquests that extended the boundaries of his empire chiefly as they served to extend the boundaries of science. It was not until the times of Nero that the *parrots* of Africa became known to the Romans. (Pliny, *Hist. Nat.*, vi. 29.) Some of these birds were among the discoveries made in the course of an expedition sent out by that prince. They came apparently from the neighbourhood of the Red Sea; and it is probable that as that country became more known, numbers of the same race were imported from it into Rome, and formed the chief part of those victims of the parrot tribes, which in after-times are said to have supplied the inordinate luxury and wantonness of Heliogabalus. The Indian group thus familiar to the antients may be identified with the beautiful birds, equally the favourites of our modern times, which are brought to us from the same country, and which are distinguished by the rose-coloured collar round their neck, the brilliant emerald of their body, and the deep ruby of their bill. Pliny (*Hist. Nat.*, x. 42) points out distinctly the former character. Solinus, in general the servile copier of Pliny, confirms this description, though with a slight variation as to colour (*Polyhist.*, c. 23). Apuleius again alludes to the same characters, but more immediately and forcibly distinguishes the varying tints of the collar round the neck (*Florid.*, lib. ii.). Oppian gives the bird an epithet (ποεσίχροον ὄρνιν[*] *De Venat.*, vii. 488); while Ovid, in like manner, particularises both the emerald plumage and the deep-red bill’ (*Amor.*, ii., vi.). To this group Mr. Vigors has assigned the name of *Palæornis*.

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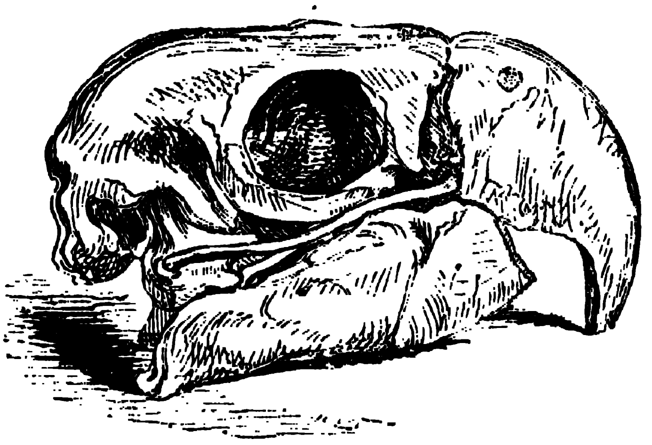
[*] The name *Psithyrus* has been used for another group of insects; the term *Apathus* therefore should be adopted to prevent confusion.

[*] *De Nat. Anim.*, xiii. 18. See also Strabo (*Geog.*, xv., p. 718, ed. Casaubon).

[†] But see Ctesias who, in the place above quoted, notices the bird called *bittacus* as having the voice and the tongue of a man, alluding to its size as being about that of a hawk (*ἱέραξ*), and to its red bill (*πορφύρεον πρόσωπον*) &c. We are further told (loc. cit.) that the bird speaks like a man in the Indian language, but that it speaks Greek also, if it is taught.

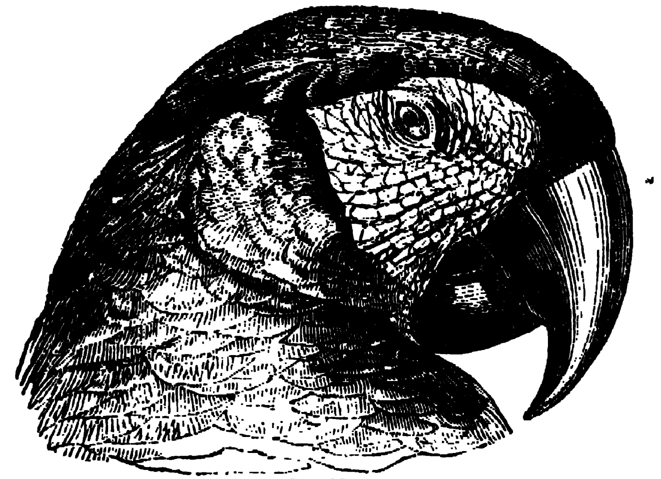
ORGANIZATION.

The upper mandible, which is immoveable in mammals, has more or less motion in birds, as we have seen. [BIRDS, vol. iv. p. 423.] Some birds indeed, for instance the capercailzie and rhinoceros birds, are not gifted with this motion; but mobility of the upper mandible is the rule in this class, and the want of it the exception. In the *Psittacidæ* this power is highly developed; for the upper mandible is not connected into one piece with the skull, by yielding and elastic bony plates, as is the case with birds in general, but constitutes a particular bone, distinct from the rest of the cranium, and articulated to it.

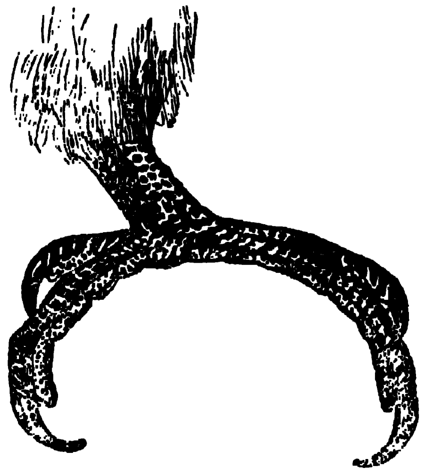


Skull of Maccaw.

The advantages derived to the animal from this conformation are obvious to any one who watches a parrot taking its food or using the bill as a third extremity to assist it in climbing about its cage. In most birds there is a progressive increase in the number of the phalanges of the toes: thus the great toe has two, the next three, the middle toe four, and the outer toe five. The parrots possess a peculiar cross-bone belonging to the great toe. In common with the pigeon and some other birds, they are destitute of a gall-bladder. Their intestines are very long, and are without cæca. The soft thick tongue so characteristic of this tribe must be a highly sensitive organ of taste. It is covered with papillæ, and moistened with a salivary secretion, so that they are able to taste and select different articles of food. In some of the forms, the *Trichoglossi* for instance, which feed on the nectar of flowers, the brush-like tongue is fringed with tubular processes, in conformity with the suctorial mode of feeding adopted by these birds. One of them kept by Mr. Caley, on seeing the coloured drawing of a plant, made an attempt to suck the flowers, and evinced the same disposition towards a piece of printed cotton furniture. (Post, p. 90.) The accurate observer last mentioned supplied the *Psittacus pusillus*, Lath., a species of the same genus, with honey and moistened sugar, which it sucked with ease and apparent pleasure by means of its brush-like tongue. In the museum of the College of Surgeons there is (No. 1479 c, *Physiological series*) one of these tubular tongues described as the tongue of a Lory (*Lorius Domicella*, Vigors). The tongue is short, thick, and fleshy, as in most of the parrot tribe; but it is further distinguished by terminating in a number of very delicate and close-set filaments, which can be protruded and expanded like a brush. (*Cat.*, vol. iii., part 1.) The plumage of this extensive family is of the most rich and varied description, embracing almost every colour and gradation of tint. The Zoological Society of London possesses one of the finest, if not the finest, living collections of these splendid birds in the world. The quantity of mealy dust discharged from the skin by the cockatoos, and other species of parrots, particularly at pairing time, is remarkable; though the separation of this peculiar matter from the skin is not confined to this family, but is effected in many birds of different orders, eagles and herons for instance. The characters of the powerful bill, and the grasping scansorial foot, which last is so constructed as also to convey the food to the mouth, will be seen below.



Head of Maccaw.



Foot of Maccaw.

This large, hard, and solid bill, rounded throughout, and surrounded at its base with a membrane wherein the nostrils are pierced, together with the thick fleshy and rounded tongue, gives the *Psittacidæ*, as Cuvier observes, the greatest facility in imitating the human voice, a facility to which their complicated lower larynx, with its three peculiar muscles on each side, contributes. Their strong mandibles, formed for shelling and cracking the hardest fruits, are worked by more numerous muscles than those of other birds.

Geographical Distribution and Habits.—The Parrot-tribe are found in great numbers in warm climates, and principally in the torrid zone. They are however abundant in the southern hemisphere, and occur even in high latitudes, whilst in the north they do not appear to be represented beyond the tropics by any species, except perhaps in India by *Palæornis*. Parrots occur in the southern extremity of America, throughout New Holland, in Van Diemen's Land, New Zealand, and even in Macquarrie Island, in the 52nd degree of south latitude. They are monogamous, and make their nests in the holes of trees, which they climb with their feet and bill. The shortness of their wings not permitting them to pass wide seas, the old and new continents, and even some of the large islands, have their particular species. Their food consists of fruits of almost every kind, and their natural voice is loud, harsh, and grating almost beyond endurance.

ARRANGEMENT AND NATURAL HISTORY.

Brisson places the Parrots in his thirteenth order of birds, consisting of those with two anterior and two posterior toes. This order he divides into four sections: the first, *with a straight bill*, includes the Wryneck, Woodpecker, and Jacamar as generic forms; the second, *with the bill rather*

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[*] Grass-coloured bird.

curved, the Barbets and Cuckoos; the third, *with the bill short and hooked*, the Trogons, Crotophaga, and the *Parrots;* and the fourth, with the bill long, and of the size of the head, the Toucans.

Linnæus placed the genus *Psittacus* at the head of his order *Picæ*, with the following definition:—

Bill hooked; upper mandible moveable, furnished with a cere. *Nostrils* situated in the base of the bill. *Tongue* fleshy, obtuse, entire. *Feet* scansorial.

He divided the genus, which is preceded by *Lanius* (the Shrikes), and immediately followed by *Ramphastos* (the Toucans), into the following sections:

*

Macrouri cauda cuneiformi.

This division contained the Maccaws.

* *

Macrouri minores.

This division contained *Psittacus Alexandri* and the Parrakeets generally; but both in this and the former division we find Parrots that can hardly be called 'long-tailed.' Thus in the first division we have *Psittacus nobilis* with the synonyms of 'Psittacus viridis alarum costa superne rubente of Aldrovandi (vol. i., t. 669), Sloane, *Jam.*, 2, p. 297,' '*Psittacus Amazonicus*, Briss., and *Psittacus mediæ magnitudinis Will.*, t. 16:' whilst in the second we find the *Psittacus agilis, Psittacus minor viridis* of Edwards.

* * *

Brachyuri cauda æquali.

This contained the Cockatoos, Lories, and True Parrots.

Latham's second order, *Picæ*, consisted of three sections, the second of which, *with scansorial feet*, included the *Parrots*, Toucans, Hornbills, Crotophaga, Trogon, Barbets, Cuckoos, Wryneck, Woodpeckers, and Jacamars.

M. de Lacépède makes the *Grimpeurs* the first subdivision of the first division (two anterior and two posterior toes) of the first subclass of birds. The first order of this subdivision (toes large and strong) is distinguished by a *hooked bill*, and the genera comprehended under it are *Ara* (Maccaws) and *Psittacus*, the latter consisting of all the Parrots and Parrakeets without denuded cheeks. The second order consists of the Toucans, the Trogons, the Touracos, and the *Musophagæ* or Plantain-eaters.

M. Duméril's *Grimpeurs* form his third order, the second family of which (*Levirostres* or *Cénoramphes*) consists of the Toucans, Plantain-eaters, Trogons, Touracos, Barbets *Maccaws*, *Cockatoos*, and *Parrots*.

The *Psittacini* form the first family of Illiger's *Scansores*, and include the genera *Psittacus* and *Pezoporus*. His second family, *Serrati*, consists of the Toucans (*Ramphastos* and *Pteroglossus*), *Pogonias*, the Touracos, the Trogons, and the Plantain-eaters.

Cuvier places the *Psittacidæ* between the Toucans and the Touracos: they consist of the *Aras* (*Ara*, Kuhl): *Perruches* (*Conurus*, Kuhl, divided by Le Vaillant into Perruches-Aras, which have naked cheeks (*Psittacus Guyanensis*, &c.); Perruches à queue en flèche (*Palæornis*); and Perruches à queue élargie vers le bout (*Platycercus*): *Cockatoos* (*Plyctolophus*): *True Parrots: Lories: Short-tailed Parrots* (*Psittacula*, Kuhl): and *Parroquets à Trompe*, Le Vaill. (*Microglossus*, Vieill.), of which last Cuvier thinks that the *Perruches Ingambes* (*Pezoporus*, Ill.) may be made a subgenus.

M. Vieillot's first tribe of his second order, *Sylvicolæ*, consists of the *Zygodactyli*; and the *Psittacins*, or *Psittacidæ*, form the first family of that tribe. The second family comprehends the *Macroglosses*, including the Woodpeckers and the Wryneck.

M. Temminck arranges all the Parrots at the end of his first family of *Zygodactyles*; the second family consists of the Woodpeckers, the Jacamars, and the Wryneck.

M. de Blainville (1815-1822) makes the Parrots his first order of birds (*Prehensores*), belonging to the anomalous subclass.

Mr. Vigors arranges the *Psittacidæ* in the normal group of the Scansores, or climbing-birds, and he observes that the immediate connection of the *Ramphastidæ* (Toucans) with *Psittacidæ*, which immediately follow them in his method, is not very evident. These families, he remarks, are placed next to each other by all systematic writers; and he decidedly concurs in the general views which bring them into neighbouring groups. But, he states that he is unacquainted with any forms which intimately connect the *Ramphastidæ* and *Psittacidæ*, and soften down the important difference observable in the bills and tongues of those birds. Mr. Vigors indeed, though he hazards a suggestion as to *Trogon*, declares his opinion to be that the *Psittacidæ* afford more difficulties to the inquirer into affinities than any other known group in the whole class. He remarks that in manners and general structure, as well as in the mode of using their feet and bill, the Parrots hold nearly an insulated situation among birds; and that they may perhaps be pronounced to be the only group among them which is completely *sui generis*. In the formation of his opinion that their station in nature accords with the place assigned them in his series, and that they come next to the *Picidæ* in affinity, Mr. Vigors at first felt some doubt in consequence of their bills and tongues here equally apparent, as in the case of the *Ramphastidæ*. But he was decided in his opinion by observing that while there was no other group with which they accord more closely in such characters, they possess an affinity to no birds but the *Picidæ* in the structure of the foot and the use to which they apply it. He reminds us that the leading characteristic of the *Scansores* is the faculty of climbing; and that the greater portion of the families contained in it possess what are technically called *zygodactyle* feet, or feet in which the toes are disposed in pairs, and which are generally considered as conducive to that faculty. But he remarks that the *Picidæ* and the *Psittacidæ* are the only families thus distinguished whose toes are strictly and constantly disposed in pairs; and that they are consequently the only groups which constantly benefit by that construction in climbing. The external hind toe of the other *Scansores* is, he observes, retractile: and these birds are never seen to climb, at least to that extent which is common to the two families in question. 'We may thus venture, I think,' continues Mr. Vigors, 'to separate the Parrots and Woodpeckers from the other families, and to associate them together, in consequence of the affinity in these essential characteristics of the tribe. In this point of view they will compose its normal groups as climbers *par excellence*, differing however as to the mode in which they climb; the *Parrots* using the foot chiefly in grasping the object which assists them in their ascent, and in conjunction with the bill; while the *Picidæ* rely upon the strength and straightness of the hind toes in supporting them in a perpendicular position on the sides of trees; in which posture they are also assisted by the strong shafts of the tail-feathers. While I was influenced by these general points of coincidence in placing the *Psittacidæ* and *Picidæ* together, I recognised a group which appeared to intervene between them, and to diminish the apparent distance that exists even in the form of their bill. That important group which comprises the Linnean *Barbets* evidently exhibited the expected gradation in the structure of that member; the bill of *Pogonias*, Ill., approaching most nearly that of the *Parrots* by its short strong and hooked conformation, while the straighter and more lengthened bill of the true *Bucco* united itself to that of *Picus*. Many other particulars in form, and also in extraordinary conformity in colouring, still further pointed out the affinity; and I was at length confirmed in my conjectures respecting the situation of these birds, by arriving at a knowledge of their habits being actually those of the true *Woodpeckers*, and of their chief affinity being to that group. The regular gradation by which these two families, united in their general characters, and those the characters, it must be remembered, most prominent and typical in their own tribe, are also united in their minuter points of formation, appears to me now eminently conspicuous.' With regard to these minuter points, Mr. Vigors observes that some of the *Psittacidæ*, among which he particularises *Psittacus Alexandri*, Linn. (*Palæornis*), and its congeners, partially employ the tail in supporting themselves as they climb, in a corresponding manner with the Woodpeckers. The tongue, also peculiar to the *Psittacidæ*, he remarks, becomes slenderer, and, as is said, more extensible in that group of which *Ps. aterrimus*, Gmel., is the representative, thus evincing an approximation, slight indeed, but still an approximation to the bill of the *Woodpeckers*. (*Linn. Trans.*, vol. xiv.)

M. Latreille makes the *Psittacins* the first family of the order *Grimpeurs*. He divides the family into two tribes: the first consisting of the genera *Ara*, *Perruche*, *Perroquet*, and *Kakatoës*; and the second of the genus [illegible].

In the method of M. de Blainville developed by M. Lherminier in 1827, the family of Parrots appears in the Normal subclass between the Touracos and the Humming-Birds.

In M. Lesson's *Projet de Classification*, the '*Psittacées*' appear as the first tribe (*Zygodactyles*) of the '*Insessores* or *Grimpeurs* (*Hétérodactyles*):' they are immediately succeeded by the '*Pogoniées*.'

Mr. Swainson is of opinion that the Parrots constitute the subtypical division of the *Scansores*, wherein the powers of climbing are less developed. 'If,' says Mr. Swainson, any group in nature be isolated, it is this. Possessing in themselves the strongest characteristics, there is no bird yet discovered which presents any point of connection to them: approximations indeed are certainly made towards them by the tooth-billed Barbuts (Barbets, *Pogonias*); but there is still a gap, which no genus yet discovered is calculated to fill up. On considering the relative difference between the barbuts and the parrots, we should say, theoretically, that of all the five groups among the latter, one only remains to give the typical structure.' As the Parrots appear to Mr. Swainson to form a group precisely equivalent to the true Woodpeckers, he arranges them under five genera: the Maccaws, the Parrots, the Cockatoos, the Lories, and the Ground Lories (*Platycercus*, Vig.). In the synopsis at the end of the work (*Classification of Birds*) we find the following arrangement:—

Psittacidæ.

Bill very short: the upper mandible greatly curved over the lower, which is considerably shorter.

Subfamily Maccrocercinæ. *Maccaws*.

Upper mandible greatly hooked; lower mandible much higher than broad. Tail very long, cuneated.

Genera: *Macrocercus*, Vieill.; *Conurus*, Kuhl; *Leptorhynchus*, Sw.; *Palæornis*, Vig.

Subfamily Psittacinæ. *Parrots*.

Upper mandible very distinctly toothed; lower mandible longer than it is high. Tail short, even, or rounded.

Genera: *Erythrostomus*, Sw.; *Chrysotis*, Sw. (Amazonian Parrots); *Psittacus* (Parrot of the Old World - most typical of this subfamily); *Agapornis*, Selby; *Poicephalus*, Sw.

Subfamily Plyctolophinæ. *Cockatoos*.

Head large, ornamented with a folding or procumbent crest. Bill short, very broad; the culmen remarkably curved. Tail rounded, lengthened, broad; the feathers not narrowed.

Genera: *Plyctolophus*, Vieill. (subtypical); *Licmetis*, Wagl.; *Microglassus*, Geoff.; *Centrourus*, Sw.

Subfamily Lorianæ. *Lories*.

Bill but slightly curved; the margin of the upper mandible sinuated; the notch obsolete; lower mandible slender, conic, much longer than high; the gonys (typically) straight.

Genera: *Brotogeris*, Vig.; *Psittaculus*, Kuhl; *Trichoglossus*, Vig.; *Lorius*, Brisson; *Pyrrhodes*, Sw.

Subfamily Platycercinæ. *Loriets*.

Tail long, very broad, considerably cuneated. Bill strong, thick, toothed: the culmen very convex. Under mandible deep, but very short: the gonys curved. Feet and toes slender. Tarsus longer than the hallux.

Genera: *Vigorsia*, Sw.; *Platycercus*, Horsf. and Vig.: *Nanodes*, Horsf. and Vig.; *Leptolophus*, Sw.; *Pezoporus*, Ill. (Swainson).

The family is placed by Mr. Swainson between the *Ramphastidæ* and the *Picidæ*.

Mr. G. R. Gray (*List of the Genera of Birds*) also arranges the *Psittacidæ* between the *Ramphastidæ* and the *Picidæ*, in the following method:—

Subfamily I. Platycercinæ.

Genera: *Coracopsis*, Wagl. (*Psittacus*, Linn.; *Muscarinus*, Less.; *Vigorsia*, Sw.).

Prioniturus, Wagl. (*Psittacus*, Vieill.).

Platycercus, Vig. (*Psittacus*, Lath.).

Nymphicus, Wagl. (*Psittacus*, Lath.; *Calopsitta*, Lath.; *Leptolophus*, Sw.).

Subfamily II. Araïnæ.

Genera: *Ara*, Briss. (*Psittacus*, Linn., *Macrocercus*, Vieill., *Sittace*, Wagl., *Arara*, Spix): *Anodorhynchus*, Spix (*Psittacus*, Lath., *Macrocercus*, Vieill.—Ex. *Hyacinthine Maccaw*); *Conurus*, Kuhl (*Psittacus*, Shaw, *Aratinga*, Spix, *Psittacara*, Vig., *Sittace*, Wagl., *Macrocercus*, 2nd div. Vieill.): *Enicognathus*, G. R. Gray (*Psittacara*, King, *Sittace*, Wagl., *Leptorhynchus*, Sw., *Psittacaria*, Meyen).

Subfamily III. Palæorninæ.

Genera: *Trichoglossus*, Vig. and Horsf. (*Psittacus*, Linn., *Australasia*, Less.); *Palæornis*, Vig. (*Psittacus*, Linn., *Psittaca*, Br., *Conurus*, Less.); *Pezoporus*, Ill. (*Psittacus*, Shaw); *Polytelis*, Wagl. (*Psittacus*, Sw., *Palæornis*, Vig. and Horsf.); *Centrourus*, Sw. (*Psittacus*, Lath., *Trichoglossus*, Vig. and Horsf.); *Euphema*, Wagl. (*Psittacus*, Lath., *Lathamus*, Less., *Nanodes*, Vig. and Horsf.).

Subfamily IV. Lorinæ.

Genera: *Charmosyna*, Wagl. (*Psittacus*, Gm., *Psittapous*, Less., *Pyrrhodes*, Sw., *Palæornis*, Vig.); *Brotogeris*, Vig. (*Psittacus*, Lath., *Trichoglossus?* Steph., *Coriphilus*, Wagl., *Lorius* and *Lathamus*, Less.); *Lorius*, Briss. (*Psittacus*, Linn., *Domicella*, Wagl.); *Eos*, Wagl. (*Psittacus*, Gm.); *Electus*, Wagl. (*Psittacus*, Gm.); *Psittacodis*, Wagl. (*Psittacus*, Linn., *Muscarinus*, Wagl.).

Subfamily V. Psittacinæ.

Genera: *Tanygnathus*, Wagl. (*Psittacus*, Linn., *Muscarinus*, Less., *Erythrostomus*, Sw.); *Triclaria*, Wagl. (*Psittacus*, Spix, *Erythrostomus*, Sw., *Maximilicus*, Less.); *Psittacus*, Linn. (*Jaco*, Less.); *Chrysotis*, Sw. (*Psittacus*, Linn., *Androglossus*, Vig.?); *Pionus*, Wagl. (*Psittacus*, Linn.); *Poicephalus*, Sw. (*Psittacus*, Linn., *Pionus* β., Wagl.); *Agapornis*, Selby (*Psittacus*, Kuhl, *Psittacula*, Wagl., *Poicephalus*, Sw.); *Psittacula*, Kuhl (*Psittacus*, Lath., *Psittaculus*, Sw.); *Nasiterna*, Wagl. (*Psittacus*, Quoy and Gaim., *Micropsitta*, Less.).

Subfamily VI. Cacatuinæ.

Genera: *Cacatua*, Briss. (*Psittacus*, Linn., *Plyctolophus*, Vieill., *Kakadoe*, Kuhl); *Calyptorhynchus*, Vig. and Horsf. (*Psittacus*, Lath., *Cacatua*, Vieill., *Banksianus*, Less., *Plyctolophus*, Sw.); *Corydon*, Wagl. (*Psittacus*, Lath., *Plyctolophus*, Sw., *Calyptorhynchus*, Vig. and Horsf.); *Licmetis*, Wagl. (*Psittacus*, Kuhl, *Cacatua*, Less.); *Microglossum*, Geoffr. (*Psittacus*, Gm., *Cacatua*, Vieill., *Probosciger*, Kuhl, *Solenoglossus*, Rantz., *Eurhynchus*, Latr.); *Nestor*, Wagl. (*Psittacus*, Forst., *Plyctolophus*, Gould); *Dasyptilus*, Wagl. (*Psittacus*, Less., *Psittrichas*, Less., *Centrourus*, Sw.).

Of the genera here stated, *Leptorhynchus* is noted as having been previously employed; and *Nanodes* and *Polytelis* as being similar to a word used in entomology. Other forms are marked in the subfamily *Psittacinæ*, viz. *P. Feildii*, Sw., *P. pileatus*, Scop., and *P. mitratus*, Pr. Max., with a query as to whether they are not entitled to rank as genera.

It is impossible to read this elaborate catalogue without being struck with the labyrinth of names in which the unfortunate student must find himself involved. In too many instances the genera thus coined bear the impress of crude theory, and those who promulgate them would find it very difficult to define the characters on which they ought to rest.

We proceed to lay before the reader some of these forms.

Macrocercus.—The *Maccaws* are all natives of America, and principally of its southern portion. The *Carolina Arara* (*Psittacus Carolinensis*, Linn.) has been recorded as occurring in the United States as high as lat. 42°, though, according to Audubon, few are now to be found higher than Cincinnati; but the true Maccaws are natives of much warmer latitudes. Though the tongue is thick, fleshy, and soft, their powers of imitation fall far short of those of the true Parrots and Parrakeets, and the harsh tones with which, after much teaching, they not very perfectly articulate a few words, contrast strongly with the assumed musical voice and ready docility of the latter. They are however capable of great attachment when domesticated. Their natural notes are screams of the most discordant and piercing kind. The hollows of trees are the places selected for their nests, and the number of eggs laid amounts to two, which are said to undergo the incubation of the male as well as the female.

The Great Green Maccaw (*Psittacus militaris*, Auct.), inhabiting the warmer districts of the chain of the Andes, where it is found as high as about 3000 feet, in Mexico and Peru; the *Hyacinthine Maccaw* (*Macrocercus Hyacinthinus*; the *Red and Blue Maccaw* (*Macrocercus Aracanga*; and the *Blue and Yellow Maccaw* (*Macrocercus Ararauna*), are known to most admirers of this gay race; though the *Hyacinthine Maccaw* is rarely seen alive in this country, and is not common even in museums.

Generic Character.—Size large. *Orbits* and sometimes the face destitute of feathers. Nostrils concealed. Notch in the upper mandible obsolete; the under remarkably short, but very deep. (Sw.)

We select as an example *Macrocercus Araráuna.*

Description.—Bill black, largely and strongly developed. The upper mandible, which not unfrequently measures from the forehead to the tip 3½ inches, is much deflected: the under mandible is short, deep, and very stout. Cheeks white, naked, with three fine narrow lines of black plumelets under the eyes, the irides of which are yellowish. Beneath the under mandible a broad black band extending upwards to the ears behind a great part of the white naked patch. Plumage rich blue above, blending into green on the forehead, crown, some of the smaller wing-coverts, and rump. Greater quills and tail nearly violet. Wings and tail, beneath, yellow. The rest of the under parts rich saffron. Legs and feet blackish-grey. Total length about 39 inches, of which the tail measures some 24 inches.

Geographical Distribution.—Tropical America. The Brazils, banks of the Marañon, or Amazon river, Guiana, Surinam, &c.

Habits.—Though generally living in pairs, the Blue and Yellow Maccaws sometimes assemble in large flocks, their favourite haunts being swampy woods where a species of palm on whose fruit they principally feed is abundant. They fly well and often very high, showing a great command of wing, especially before they alight on the top of the lofty trees which they select for their resting-place. The two eggs, which are laid in the hollows of decayed trees, as well as the young, are said to receive the parental care of the male as well as of the female, which have two broods a year generally. Mr. Selby (*Naturalist's Library—Parrots*) notices a very fine individual completely domesticated at Dr. Neill's, Cannonmills (near Edinburgh), which is allowed the freedom of several apartments; and he tells us that when the bird is desirous of being noticed, it calls out 'Robert,' the name of its earliest master, very distinctly, but that it has not acquired more than one other conventional sound.

Macrocercus Ararauna.

Psittacara.—Between the *Maccaws* and *Parrakeets* (*Palæornis*) comes the genus *Psittacara* (Vig.). 'These birds,' says Mr. Vigors, 'although their cheeks are covered with feathers, and they are thus brought within the circle of the *Parrakeets*, have yet the bill of the *Maccaws*; and by a greater or less nakedness of the orbits round the eyes they still further assert their affinity to them. From their osculant situation between the two groups, thus strikingly apparent, the species that exhibit these characters have received the familiar name of *Parrakeet-Maccaws* in our language, and of *Perruche-Aras* among the French ornithologists. Like the true Maccaws, they are exclusively natives of the New World.' (*Zool. Journ.*, vol. ii.) Mr. Vigors adds in a note, that a species nearly allied to both these groups had then lately been brought to this country.

Generic Character.—*Head* feathered, space round the eye naked. *Bill* thick, rather short; upper mandible compressed at the apex, the lower mandible very short inclining inwards, deeply emarginate. *Wings* moderate; first and fourth quills equal, third rather longer, second longest; internal web of the first slightly notched near the middle, external webs of the second to the fifth inclusive gradually broader in the middle. *Feet* rather strong, *tarsi* short. (Vig.)

Example, *Psittacara leptorhyncha.*

Description.—Green; space round the eye white; interocular band and frontal fillet red; tail cinnamon red.

Psittacara Leptorhyncha.

The subfamily *Palæornina*, as it appears in Mr. Vigors and Dr. Horsfield's *Description of the Australian Birds in the Collection of the Linnæan Society* (*Linn. Trans.*, vol. xv.), consists of the genera *Nanodes*, *Platycercus*, *Pezoporus*, *Palæornis*, and *Trichoglossus*.

Palæornis.—The Parrakeets forming this group belong to Continental India and some of the neighbouring islands in the Indian Ocean and Africa, with the exception of *Palæornis Barrabandi* (*Polytelis* of Wagler), which is a native of New Holland. India and its islands must however be considered as the principal locality of the species, which, according to Wagler's monograph, amounts to eleven, including *Palæornis inornatus* (*Psittacus incarnatus* of authors), which he adds to the group with doubt.

These *Ring Parrakeets*, as they are generally termed, are justly held in high estimation for the symmetry of their form, the grace and elegance of their movements, the beauty of their colours, their great docility and powers of imitation and their fond attachment to those with whom they [illegible] domesticated and who treat them with kindness. They were not less prized, as we have seen, by the antients; and it becomes a not uninteresting inquiry to endeavour to ascertain what were the species known to them. Some suppose that *Palæornis Alexandri* was the only one: but though that species may have been and was probably the first introduced into Europe, we think it will appear that those who confine the Parrakeets known to the antients to that bird have taken too narrow a view of the subject.

Mr. Vigors, in the paper above alluded to, says—

'It is not easy to decide, although we may form a probable conjecture on the subject, how many and which of the species of *Palæornis* were known to the antients. Ælian (*De Nat. Anim.*, xvi. 2) tells us that they were acquainted with three species. But as some of the more common species approach each other most closely in their specific characters, it is not improbable that the differences between them might have been passed over by observers who were so little accustomed and had so little occasion to pay attention to minute distinctions, and that four or five species at least were familiar to antiquity. The birds that come from the remoter Indian islands, *P. Papuensis*, *Malaccensis*, and *Xanthosomus*, in particular, are in all likelihood among the number of those which have been only known in recent times. To these may of course be added the newly-characterised species from New Holland, the *P. Barrabandi*. The beautiful blossom-headed species also, *P. erythrocephalus* and *Bengalensis*, which are even now more rarely met with than the neighbouring species, most probably did not come under the observations of the antients; for it is impossible that they should have passed over without notice the lovely and changeable roseate colour of the head, which casts into the shade even the collar round the neck so frequently alluded to by them, if either of these birds had been before them. The poets at least would have seized upon a character which involved so truly poetic an image, and Ovid or Statius would have woven it up among the most conspicuous wreaths of their beautiful elegiac garlands. *P. bitorquatus*, the locality of which is unknown, is at present of rare occurrence; but it formerly might have been more generally distributed. The species which we can imagine to have been best known to former times are the *P. Pondicerianus* and *flavitorquis*, which are diffused over the whole of the Indian continent, the former species more particularly, which is now also found dispersed over a great extent of the Eastern Archipelago. *P. Alexandri* appears to have been the bird sent from Ceylon to the Macedonian warrior from whom it derives its specific name; Ceylon, or the antient Tabrobana, being the principal resort, even down to the present moment, of that species. And it is probable also that the Romans, particularly in later times, received a great number of the same species from that island.—If to these birds we add the *P. torquatus*, which is the species that agrees most intimately with the descriptions of Pliny, and, after him, of Apuleius, and which is generally scattered over the Indian as well as the African continent on the eastern side, we shall probably have before us all the species known to the antients of this classical group.'

Palæornis Alexandri.

Generic Character.—*Bill* rather thick; the upper mandible dilated, the culmen round, the lower mandible broad, short, and emarginate. *Wings* moderate; three last quills (extimis) nearly equal, longest; external webs of the second, third, and fourth gradually broader in the middle. *Tail* graduated; the two middle very slender feathers much exceeding the rest in length. *Feet* with short and weak tarsi; the claws moderate, rather slender, and falcate. *Body* slender and neat. (Vig.)

Mr. Vigors divides the genus into the following sections:—

* Lower mandible short.

P. Alexandri, *P. torquatus*, *P. flavitorquis*, *P. bitorquatus*, *P. Xanthosomus*, *P. Malaccensis*, *P. erythrocephalus*, *P. Bengalensis*, *P. Pondicerianus*, *P. Barrabandi*.

** Lower mandible elongated.

P. Papuensis.

We select as an example the generic type, *P. Alexandri*.

Description.—Green, with a vermillion collar; throat and band between the eyes black; spot on the wings purple-red. Differs from *P. torquatus* by the greater size of the bill and the dark red spot on the shoulders. (Vig.)

Locality.—Ceylon and parts of the continent of India.

Platycercus (*Loriets*).

Generic Character.—*Bill* rather short, the upper mandible rounded and dilated, the lower one short, deeply emarginate, with the apex squared. *Wings* rounded; the first quill shorter than the second and equal to the fifth; second and third longest; the external webs of all except the first abruptly notched towards the middle. *Tail* broad, depressed, rather rounded or sub-graduated; the tail-feathers rounded at the apex. *Feet* with elevated tarsi; the toes slender and elongated, and the claws long and but little falcated.

Example, *Platycercus scapulatus*, *Tabuan Parrot*, or *King's Parrot*.

Description.—*Male.*—Green; the head, neck, and body beneath scarlet; nuchal lunula and rump lazuline; longitudinal scapular line pale green-cerulean; tail-feathers black, with brilliant green reflections.

Female.—Head and neck green.

Locality.—New Holland.

Habits, &c.—Mr. Caley seldom noticed a full-coloured specimen, that is, red. He states that, when the Indian

Platycercus scapulatus.

corn is ripe, they may be seen in large flocks on the farms, clinging on the stalks and occasioning much mischief to the corn. He apprehends that the greater part of these flocks are young birds, as it is rare to see a bright red one among them. The natives told him that this species breeds chiefly in a white gum-tree (a species of *Eucalyptus*), making its nest of a little grass, and lining it with feathers. It has, he adds, as many as twelve young ones, and the eggs are of a dirty white with black specks: the nest is found by its enlarging the hole at which it creeps in; this process gives the surrounding part a reddish appearance, which, forming a contrast with the whiteness of the other parts, renders it conspicuous.

Mr. Swainson had one of these beautiful birds alive in his possession for many years. Its manners were gentle and timid. Like many of its congeners, it delighted to wash itself in a basin of water. In the day and during winter it was generally silent; but on a mild evening it would go on for two or three hours with a somewhat whistling note, sometimes shrill, but generally soft and pleasing. Its ordinary diet was moistened bread, with a little hemp and canary seed; but during summer and autumn the small garden fruits appeared to be highly welcome to it. (*Zool. Ill.*, 2nd series.)

Nymphicus.

Generic Character.—*Bill* distinctly toothed, culmen slightly carinated; *nostrils* thick, tumid, naked; *head* crested; *wings* very long, outer web of the quills not sinuated; *tail* very broad, cuneated, the two middle tail-feathers conspicuously longest and pointed. (Sw.)

(Mr. Swainson considers this to be the rasorial type.)

Example, *Nymphicus Novæ Hollandiæ.*

Description.—*Male.*—Forehead, crest, and cheeks lemon-yellow; ear-coverts rich reddish-orange; back of the neck, two centre tail-feathers, and the external margins of the primaries brownish-grey; back, shoulders, and all the under surface and outer tail-feathers greyish chocolate-brown, the shoulders and flanks being the darkest; a white mark extends from the shoulders lengthwise down the centre of the wing; bill and bare space round the eye brownish-grey; feet blackish-brown.

Nymphicus Novæ Hollandiæ

Female.—Differs from the male in the colour of the face and crest being of a dull olive-yellow, the latter becoming still darker at its extremity; in having the throat greyish-brown and the back lighter than in the male; the lower part of the abdomen, upper tail-coverts, and tail-feathers yellow, except the four middle ones, which are grey; the whole transversely and irregularly barred with lines of brown. Total length twelve inches.

Locality.—New Holland.

Habits, &c.—Mr. Gould, whose accurate description we have given from his grand work on the *Birds of Australia*, now in the course of publication, states that this species has many of the actions of the *Platycerci*, being extremely active and running round its cage with surprising agility, in which particular it is only equalled by the most terrestrial members of the family. To give some idea of the immense flocks of this beautiful bird which inhabit the interior of Australia, the same author informs us that his brother-in-law, Stephen Coxen, Esq., procured more than two hundred examples during a single excursion into the interior.

Euphemia, Wagl. (*Nanodes*, Vig.).

Generic Character.—*Bill* short, the culmen rounded, higher than it is long, being very like that of *Macrocercus*, the lower mandible very short, inclining inwards, and emarginate. *Wings* moderate, subacuminate; first and second quills, which are nearly equal, longest; the external webs of the second and third slightly emarginate towards the apex. *Feet* moderate; *tarsi* and *toes* rather slender. *Tail* graduated, cuneated; tail-feathers slender towards the apex. (Vig.)

Example, *Euphemia undulata.*

Description.—*Male.*—Crown of the head and throat pale yellow, the latter ornamented on each side with several rich blue spots, a row of which, but of a darker tint, crosses the throat in the form of a crescent; sides and back of the head, back of the neck, upper part of the back, scapulars and wing-coverts olive brown, each feather having a crescent-shaped mark of black near its extremity, and margined with yellow; primaries green on their outer edges, the tip and internal web brown; secondaries crossed by a broad band of yellow, which is continued, but much narrower, across some of the primaries; breast, all the under surface, lower part of the back, and the tail-coverts fine pale green; two centre tail-feathers deep blue at the base, passing into deep green at the tip; the remainder of the tail-feathers bright yellow, tipped with dark green; bill horn-colour at the base, passing into pale yellow at the tip; feet flesh-colour.

Female.—Differs in being less brilliant in all her markings, and in having the blue spots on the throat less defined and irregular in form. Total length seven inches and a half. (Gould, *Birds of Australia.*)

Locality.—Interior of New South Wales.

Euphemia undulata.

Habits, &c.—Captain Sturt discovered this species in great abundance in the interior of New South Wales. He informed Mr. Gould that on the extensive plains bordering the Morumbidgee he met with it in immense flocks, feeding upon the seeds and berries of the low stunted bushes called scrubs. Mr. Gould also received several from Mr. Coxen, which the latter had procured to the north of Hunter's River. Mr. Gould adds that they are quick and active, and run on the ground with great facility, much after the manner of the true *Platycerci*, or Ground Parrakeets, to which he is of opinion they are closely allied in affinity.

Trichoglossus (*Lorikeets*).

Generic Character.—*Bill* somewhat elongated, rather compressed; lower mandible nearly straight, the margin entire, longer than it is high. *Tongue* furnished below with many marginal bristles at the apex. *Wings* moderate; first *quill* longest, second and third a little shorter, webs entire. *Feet* rather short; *tarsi* somewhat covered with the femoral feathers; *acrotarsi* a little feathered below the knee: toes rather strong, depressed; *claws* strong, falcate. *Tail* graduated; the tail-feathers rather narrower at the apex. (Vig.)

Locality.—New Holland.

Mr. Vigors (*Linn. Trans.*, vol. xv.) remarks, that besides the external characters specified above, which separate this genus from the rest of the subfamily *Palæorninæ*, a decided ground of distinction is exhibited in the formation of the tongue; the under part of this member being furnished at the apex with numerous strong hairs or bristles, of a brush-like structure, and which seem to serve the bird for the purposes of suction. (Ante, p. 84.) He remarks that the tendency of a considerable portion of the birds of New Holland to feed by suction upon vegetable juices, for which a sufficient provision is made by nature in the luxuriant vegetation and the constant succession of flowers in that country, renders this singular deviation from the general form of the *Parrot's* tongue less surprising; and he further observes that it is to be remarked that although the *Parrots* are in general a long-lived race, and of all birds perhaps the most easily reared, and although the birds of the present group are most numerous in New Holland, few of them have been kept alive for any length of time in a state of confinement. He accounts for this from the probable ignorance of their natural mode of feeding.

The natural and acquired habits of the species of this genus require some notice. Mr. Caley informs us that the *Blue mountain Parrot*, *War'rin* of the natives (*Trichoglossus hæmatodus*), is remarkable for its docility and attachment to some people, whilst it is a perfect scold to others who may have teazed or offended it. 'Flocks of these birds,' says this accurate observer, 'may be seen in the *Eucalypti* trees when in flower, in different parts of the country, but in the greatest number near their breeding-places. It does not eat any kind of grain, even when in a domesticated state. It is much subject to fits, which generally prove fatal; and it is rare to find an individual kept alive above a couple of years. One that I kept, on being shown a figure of a coloured plant, used to put its tongue to the flowers, as if with the intent of sucking them; and I have seen it make the same attempt with a piece of cotton furniture. The flesh of this bird is very good eating.' Again, speaking of the *Crimson-fronted Parrakeet*, *Coolich* of the natives (*Trichoglossus concinnus*), Mr. Caley states that it may be observed in large flocks sucking the *Eucalypti* flowers. He adds that, like the *Blue-mountain Parrot*, it is subject to fits, which generally prove fatal, that it is seldom kept alive, and that its breath or some part about its head emits a very sweet odour. The natives told him that this species breeds in the hollow boughs of trees, scraping out the decayed mould, and making its nest of it. The eggs, he informs us, are green, without spots, and the number of young two. Of the *Small Parrakeet*, *Jerryang* of the natives (*Trichoglossus pusi*[illegible]), he observes that this, like the *Coolich*, is seen in very large flocks in the *Eucalypti* trees when in blossom. 'The natives,' says he, 'now and then bring in the young ones, but they seldom live long. I had three young ones for some time, which used to huddle together and give out a very pleasing note. They all died, strongly convulsed, and nearly at the same time; the limbs were as stiff the moment life was extinct as if the body had become cold. The natives tell me that it builds in the hollow limbs of trees, making no other nest than of the decayed wood. It has four young ones. The eggs are white, and without spot.'

Mr. Caley also learned from the natives that the nest of this species, of the *Ground Parrot* (*N. pulchellus*), of the *Dulang* (*Pl. Pennantii*), and of the *Coolich* (*Tri. concinnus*), smell very strong and offensive of dung.

Example, *Trichoglossus hæmatodus* (Vig., *Trichoglossus Swainsonii*, Jardine and Selby).

Description.—Green; head, middle of the body, and bands on the sides azure-blue; throat, breast, and flanks orange crimson. (Sw.)

Blue-bellied Parrakeet.

Lorius.—The true Lories are remarkable for the elongated and weak form of the bill, and also for a formation of the tongue, similar to that in *Trichoglossus*. (Ante, p. 84.) They are inhabitants of the islands of the East, and are considered by Mr. Vigors to be the aberrant group of the family. Their colours are of the most rich and mellow description, and the birds are highly prized, not only for their beautiful plumage, but for their lively, active, and affectionate disposition, and their great docility in the articulation of words and even sentences.

Generic Character.—*Bill* elongated, weak. *Wings* pointed, two first quills longest. *Tail* moderate, rounded or graduated; the feathers broad, and hardly narrow at their tips.

Example, *Lorius Domicella*.

Lorius Domicella.

Description.—Rich scarlet; upon the upper part of the breast a yellow collar; crown of the head blackish purple in front, passing into violet-purple behind; upper surface of the wings green, violet-blue at the bend and margins, as are the under wing-coverts; thighs externally azure, greenish at the base; bill orange-yellow; length between 11 and 12 inches.

Locality.—The Moluccas and other Eastern Islands.

The *Plyctolophinæ*, or *Cockatoos*, are natives of Australia and the Indian Islands, inhabiting the woods, and feeding upon seeds and soft and stony fruits, which last their powerful bill enables them to break with ease. Like others of their congeners, they make their nests in decayed trees, and are easily tamed when taken at an early age. They become familiar and even attached, but their imitative powers seldom go beyond a very few words added to their own cry of 'Cockatoo.'

Plyctolophus (*True Cockatoos*).

Generic Character.—*Bill* strong, short, very broad, culmen much curved. *Head* with a folding crest. Base of the under *mandible* frequently concealed by feathers. *Wings* long; secondaries, tertiaries, and the tail-feathers sometimes mucronate.

Example, *Plyctolophus galeritus* (*Crested Cockatoo*, White).

Description.—White, crest, and internal webs of the lateral tail-feathers yellow; under wing-coverts sulphureous.

Locality, New Holland.

Habits, &c.—Mr. Caley's notes contain the following observations on the Crested Cockatoo:—'This bird is called by the natives *Car'away*, and also *Curriang*. I have met with it in large flocks at the conflux of the Grose and Hawkesbury rivers, below Mulgo'ey on the former river, and in the long meadow near the Nepean river. They are shy, and not easily approached. The flesh of the young ones is accounted good eating. I have heard from the natives that it makes its nest in the rotten limbs of trees, of nothing more than the vegetable mould formed by the decayed parts of the bough; that it has no more than two young ones at a time, and that the eggs are white without spots. The natives first find where the nests are by the bird making *Co'tora* in an adjoining tree, which lies in conspicuous heaps on the ground. *Co'tora* is the bark stripped off the smaller branches, and cut into small pieces. When the young ones are nearly fledged, the old birds cut a quantity of small branches from the adjoining trees, but never from that in which the nest is situated. They are sometimes found to enter the hollow limb as far as two yards. The nests are generally formed in a *Black butted* Gum-tree; and also in *Coroy'bo*, *Cajim'bbora*, and *Yarrowar'ry* trees (species of *Eucalyptus*). Their breeding-places appear to be local.'

Plyctolophus galeritus.

Mr. Vigors divides the genus into the following sections:

Cristâ plicatili, acuminata, antrorsum tortâ.

Of this division he gives *Plyctolophus galeritus* above described as the example.

* *

Cristâ rotundatâ, retrorsum incumbente.

Of this section he gives the *Rosalbin Cockatoo*, *Plyctolophus Eos*, *Psittacus Eos* (Kuhl) as the example.

The *Tricolour-crested Cockatoo*, *Plyctolophus Leadbeateri*, Vig., *Cacatua Leadbeateri*, Wagl., also a native of New Holland, is the most splendid species yet discovered. Nothing appears to be known of its habits. In Mitchell's interesting Journal, where a coloured figure of the bird is given, it is called the Cockatoo of the Darling, and the enterprising author states that a flight of them flew over the heads of his party from the north-west when he was endeavouring to ascertain the final course of the Lachlan. The species is beautifully figured in Lear's 'Parrots,' and in the volume on Parrots by Sir W. Jardine and Mr. Selby. (*Naturalist's Library*, 'Ornithology,' vol. vi.)

In the same family of *Plyctolophinæ* Mr. Vigors places his genus *Calyptorhynchus*, the chief difference between which and *Plyctolophus* consists in the greater elevation and comparative shortness of the bill. The species appear to be confined to Australia. Of *Calyptorhynchus Banksii*, *the Banksian Cockatoo*, Mr. Caley says, 'The native name of these birds is *Geringora*. I have met with them in various parts of the country. In the north rocks, a few miles to the northward of Paramatta, I have frequently seen them, but never many together. The natives tell me it breeds in winter in *Mun'ning-trees*, or *Blood-trees* of the colonists (a species of *Eucalyptus*), but makes no *Co'tora*. It has three young ones, but of the eggs I could obtain no information.'

Of the *Calyptorhynchus funereus*, *Funereal Cockatoo*, Mr. Caley says, 'Its native name is *Wy'la*, so called from the similitude of that word to the sound which it makes. I have never seen them together in any numbers, not more perhaps than half-a-dozen at a time; but I have met with them in many different places. Sometimes they come within half a mile of the centre of Paramatta, where I have shot them in the trees. The natives told me it made its nest in *Yar'ro-trees* (a species of *Eucalyptus*), using only the vegetable mould. It makes no *Co'tora*, but cuts off the small branches of *Apple-trees* (a species of *Angophora*). It has two young ones.'

Mr. Vigors and Dr. Horsfield have no doubt that the following observations in Mr. Caley's notes apply to *Calyptorhynchus Cookii*, *Cook's Cockatoo*. 'The natives,' says the last-mentioned traveller, 'tell me of another kind of Cockatoo (besides *Wyla* and *Geringora*, which they call *Carat*). It is very shy. It scrapes dirt out of the hollow boughs, and makes its nest as the others do. It lays two eggs, the colour of which I did not ascertain. The nest is found by watching the bird into the hole. It does not make *Co'tora*, nor cut off the branches of the trees; but it cuts off *May'rybor'ro* and *Mun'mow* (the fruit of two species of *Persoonia*), without however eating them, before they are ripe, to the great injury and vexation of the natives.' Specimens of these three species of *Calyptorhynchus* and of *Cal. Solandri* will be found in the collection of Australian birds in the possession of the Linnean Society of London.

Here may be noticed the *Aratoo* (*Microglossus* of Wagler), of which the *Goliah Aratoo*, *Microglossus aterrimus*, Wagl., *Great Black Cockatoo* of Edwards, is an example. *Locality*, Papua, Wagiou, New Guinea, and other Eastern Australian Islands.

Psittacus (*True Parrots*).

Mr. Vigors is of opinion that the group of the *Psittacidæ*, to which the name of *Psittacus* should be applied, may perhaps be considered to be that which comprises the *Psittacus Amazonicus* of Brisson and some allied species. That at least, he observes, is the group best known under the old scientific term, and at the same time under the familiar names of *Parrot* in our language and *Perroquet* in the French, which correspond with it.

These *true Parrots* are for the most part inhabitants of tropical America, and their prevailing colour is green. The ash-coloured or grey parrot, *Psittacus erythacus*, Linn., is a native of Africa. This group excels all others in docility and power of imitation.

Mr. Swainson divides the *true Parrots* into two genera, viz.:-

1, *Chrysotis* (*Amazonian Parrots*), which he thus characterises:—

Face plumed. *Wings* rather short; the first and second quills graduated, and shorter than the third and fourth, which are the longest; all these have the inner web sinnated in the middle; tertials very long. Tail short, longer than the wings, broad, with the tips rounded.

The species of these *Green Parrots* are numerous: among them the *Festive Parrot* (*Psittacus festivus* of authors) and the *Amazon's Parrot* (*Psittacus Amazonicus* of authors) are perhaps the best known: the latter particularly, which is often brought to Europe on account of its superior mimic propensities. The former, which exceeds the *Amazon's Parrot* in size, inhabits Guiana and the Brazils, the banks of the Marañon, or river Amazon, particularly, living in the forests upon seeds and kernels of fruits. It articulates, with great clearness and precision, words, and even sentences. The smaller *Amazon's Parrot* is common in Guiana and Brazil, and more especially near the banks of the river from which it takes its name. Fruits form its food, particularly those of the *Rhizophora Mangle*, or *Mangrove-tree*, and in its decayed trunks the bird deposits its eggs. It is considered very destructive to orange plantations. In captivity it may be taught to repeat many words and short sentences, which it learns with great facility.

Sloane, in his account of the *Common Parrot of Jamaica*, says that it is lesser than those of the main, and has a reddish-coloured neck, being everywhere else of a green colour; that it has a short broad tail; speaks very articulately; and that it is eaten baked in pies, tasting like pigeons.

2. *Psittacus*.

Generic Character.—Wings lengthened, nearly as long as the tail. Face naked. Tail even; the feathers rounded. The Old World. (Sw.)

The *Common Grey Parrot*, *Psittacus erythacus*, is generally considered to be superior to all others in docility and mimicry: its imitation of the human voice, when well taught, is complete, and its articulation most clear. Very high prices have been given for clever and well-taught birds. The parrot for which the Roman cardinal gave a hundred gold pieces had, it is said, learned to repeat with clearness, and without hesitation, the whole of the apostles' creed, a wonderful instance of memory and imitation. This species is very long-lived. Le Vaillant mentions one that he saw which had been domesticated ninety-three years: it was indeed then in a state of decrepitude, and both sight and memory were gone.

Wagler's genera, *Electus*, *Pionus*, and *Psittacodis*, vary in some points from *Psittacus*; the former, *Electus grandis* (Moluccas and New Guinea), approaches the Lories.

The Australian genus *Nestor*, of the same author, is pointed out as forming a connecting link between the *Parrots* and the *Cockatoos*, and is thus characterised:—

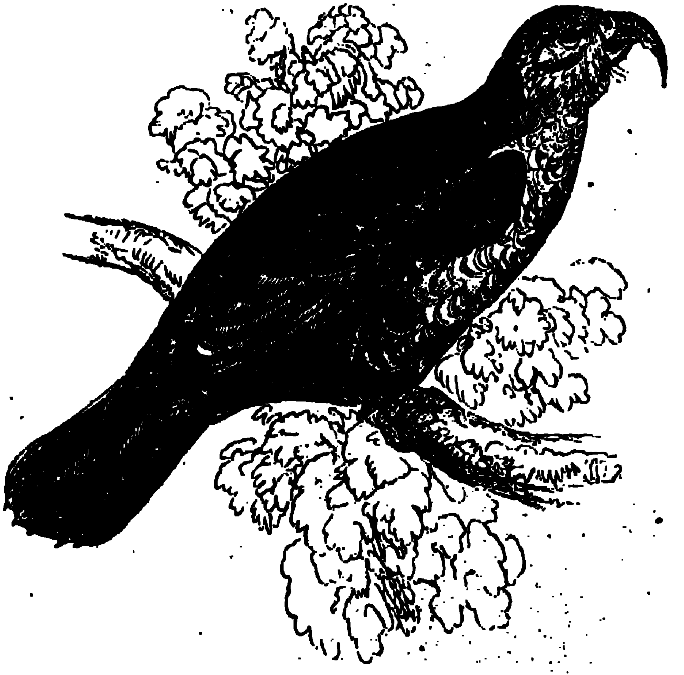
Bill elongated; upper mandible compressed, hooked; the tomia sinuated, but not distinctly toothed; the tip projecting, with its under surface sulcated and deeply excavated for the reception of the tip of the under mandible; under mandible narrow, compressed, slightly convex, or forming, when closed, an obtuse angle with the upper; wings rather long, ample; tail of moderate length, and even at the end; tips of the shafts bare, and slightly projecting beyond the feathered parts.

Example, *Nestor Productus* (*Long-billed Parrot*, Gould).

Description.—General colour of the upper surface brown; beak elongated; head and back of the neck tinged with grey; the feathers of these parts, as well as of the back, margined with a deeper tint; rump, belly, and under tail-coverts, deep red; cheeks, throat, and chest yellow, the former tinged with red; shoulders, on their inner surface, yellow, tinged with rufous-olive; tail-feathers banded at the base with orange-yellow and brown, the inner webs of the quill-feathers at the base and beneath with dusky-red and brown; bill brown; feet blackish-brown. Total length fifteen inches. (Gould, *Birds of Australia*.)

Locality.—Norfolk Island and the most eastern portions of South Wales.

Habits, &c.—'Like all the other members of this extensive family,' says Mr. Gould, in his splendid work on the Birds of Australia, speaking of this species, 'it bears captivity remarkably well, readily becoming cheerful and contented; at least such is the case with an individual in the possession of Sir J. P. Millbank, Bart.; and, as might have been reasonably expected, the variation in the form of the mandibles, which renders these birds so conspicuous, is accompanied by a marked difference in the nature of their food, the powerful bills of the other members of the family enabling them to feed upon hard seeds and stony fruits, while, from the elongated form of this organ in the present birds, this power is denied to them, and we find that they give a decided preference to the leaves of succulent plants and the softer kinds of fruit. Sir J. P. Millbank informed me that the bird in his possession evinced a strong partiality to the leaves of the common lettuce and other soft vegetables, and that it was also very fond of the juice of fruits, of cream, and butter. Its voice was hoarse and inharmonious, frequently resembling the barking of a dog; and in Yates's "New Zealand" we are informed that the *Nestor hypopolius*, known there by the name of *Kaka*, is "capable of learning to imitate the human voice to a remarkable degree. . . . The cry of this bird, when ranging at large in the woods, is harsh and disagreeable in the extreme." Although I cannot assert it for a certainty, I have every reason to believe that both these birds frequently descend to the ground and grub up with their lengthened bills the bulbous and other roots which form a portion of their food, particularly as I have found earth still adhering to the mandibles of the specimens I have examined; besides which, I have been informed by Captain Sturt that a parrot inhabiting Australia, having a similar bill, but belonging to another group, is frequently in the habit of so doing.'



Nestor productus.

The genera *Psittacula* and *Agapornis* appear to be the most diminutive of this extensive and interesting tribe. The latter, a ready example of which occurs in the *Love-Birds*, so extensively petted, and remarkable for their sexual attachment, was separated from *Psittacula* by Sir W. Jardine and Mr. Selby.

The following cut will give some idea of the form of Psittacula (*Poicephalus* of Swainson).

The student should carefully consult the monograph of Kuhl, and that of Wagler*; and of illustrated works should direct his attention more particularly to *Le Vaillant's Perroquets*, with figures after the celebrated Barraband; Lear's *Parrots*; Swainson's *Zoological Illustrations*, 1st and 2nd series; and Selby's *Parrots*, containing many beautiful figures after Lear, though on a small scale, and forming the 6th volume of the *Ornithology* of the *Naturalists' Library*.

Those who keep birds belonging to this group would do well to study their natural habits, if they wish to keep them

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* 'Transactions of the Royal Academy of Munich.'

Psittacula Taranta.

in health. Some, as we have seen, live upon the nectar of flowers, others on soft fruits, and others again on hard fruits, for breaking which they are gifted with a powerful vice of a bill. We have known a case where the upper mandible of the bill of a parrot of this last description, which had been kept upon soft food, grew to such a length as to begin to penetrate its throat. To such a moderate proportion of hard food, such as almonds, and even harder food, should be presented. Some of the tribe have bred in captivity; and there is little doubt that if pairs were kept in good roomy cages, with a part of them so fitted up as to remind them of their favourite hollow trees, and furnished with dry rotten wood or vegetable earth, the instances would be comparatively frequent.

PSITTIROSTRA, M. Temminck's name for a genus of granivorous birds, which he places between the Crossbills (*Loxia*) and the Bullfinches (*Pyrrhula*).

Generic Character.—*Bill* short, very much hooked, a little convex at its base, upper mandible curved at the point over the lower one, which is very wide (evasée), rounded and obtuse at the point. *Nostrils* basal, lateral, half closed by a membrane covered with feathers. *Feet*, tarsi longer than the middle toe; all the toes divided, lateral, and equal. *Wings*, first quill null*; second rather shorter than the third. (Temminck.)

Example, *Psittirostra Psittacea* (*Loxia Psitticea*, Lath.; *Psittirostra icterocephala*, Temm.).

M. Temminck remarks that the above is the only species known to him, and that it is found in New Holland; but he adds that he possesses a portrait of a second species, which is green, with a grey beard.

Description of Psittirostra Psittacea.—*Male.*—Head and part of the neck yellow: body entirely green olive-brown, paler below; edge of the quills and tail-feathers yellowish; tail equal; legs pale brown.

Female.—Plumage nearly the same as that of the male, but without yellow on the head, which is green and yellowish-grey upon the temples.

M. Temminck observes that this genus has the bill formed nearly like that of the Parrots, and remarks that if its toes were disposed in pairs, and nothing were known of its habits, it might be classed with them.

Mr. Swainson places the form in his subfamily *Pyrrhulinæ*, family *Fringillidæ*, between *Spermophila* and *Corythus*.

PSKOW was formerly a part of the government of St. Petersburg, and afterwards of that of Novogorod, but it was erected into a separate government by the empress Catharine II. It is situated between 56° and 58° N. lat., and between 27° 20′ and 32° 5′ E. long. It is bounded on the north-west by lake Pskow, on the north by the government of St. Petersburg, on the north-east by Novogorod, on the east by Twer, on the south-east by Smolensk, on the south-west by Witepsk, and on the west by Livonia. The area, according to the survey of 1797, is 15,183 square miles, which M. Arunoff increases to 16,128 square miles, both which are undoubtedly below the truth; but Storch, who is followed by Hassel, Schubert, and lastly, in 1838, by Koppen, makes it 21,950 square miles, which Schmidtlin thinks is perhaps too much. The population, according to Koppen, is 705,300; but Hassel, in 1820, would make it 783,000; and Hörschelmann, in 1833, states it at 900,000. It must be observed that he makes the area only 16,800 square miles.

Face of the Country, Soil, Climate.—The surface is level, and in some places slightly undulating: there are no mountains, though the whole country is rather elevated. The soil is partly clayey, partly sandy, and in many parts covered with a tolerably thick layer of mould. The eminences and the banks of the rivers contain limestone and sandstone. Boulders of granite are not rare, and are most numerous where there is an extensive plain. The only large lake is Lake Pskow, which is, properly speaking, a bay of Lake Peipus, with which it is connected by a broad channel. The Polista, Podso, Khvat, and Woiskoe lakes are much smaller; there are also numerous meres and many marshes, principally in the south-east part of the government. There is no large river in the province. The Düna rises in it, but soon turns into Witepsk; the Loweth, which also rises in it, runs into Novogorod, is joined by the Polista and the Pola, and has below Velikie Luki several rocks and whirlpools, which are called cataracts. Other rivers are the Welikaja, which runs to the north-east, and empties itself into Lake Pskow; the Szelon, which runs into Novogorod, and falls into Lake Ilmen; and the Toropez, which falls into the Düna. Most of these rivers, though not deep enough for large vessels, are however navigable by struses* and other barks, and therefore extremely useful to the government by giving it a communication with Petersburg, Narva, and Riga.

As the whole province is beyond the 56th parallel, the climate is cold.

Natural Productions.—Agriculture is the chief occupation of the inhabitants. The soil is in general tolerably fertile, but requires careful cultivation and manure; it produces however not only sufficient for the consumption of the inhabitants, but an annual surplus of about a million of chetwerts† for exportation. The grains chiefly cultivated are rye, barley, oats, and buckwheat; and of pulse, peas, beans, and lentils: very little wheat is grown. Culinary vegetables, such as cabbages, turnips, onions, garlic, and cucumbers, are cultivated. No fruit is to be seen, at least in the gardens of the peasants, who do not plant a cherry or an apple tree, but content themselves with the wild berries which grow in abundance in the woods and the marshes. On the estates of the nobility small orchards are here and there to be seen. Flax and hemp, both of excellent quality, are staple productions. The extensive forests furnish abundance of timber, chiefly pines, firs, birches, and alders: the oak, maple, and lime-tree are rare. The breeding of cattle is merely subservient to agriculture. The oxen are mostly of the Russian breed, and so are the horses, to which more attention is paid. Besides Russian sheep there are many of German breed. Swine are kept in great numbers, but only few goats and a little poultry. Birds and hares are scarce, and it is seldom that a stag or deer strays hither from the forests of Lithuania. But beasts of prey and fur-bearing animals abound, such as bears, wolves, lynxes, foxes, martens, squirrels, and badgers. Beavers and otters are nearly extinct. The lakes and rivers produce abundance of fish. The only mineral products are bog-iron, limestone, sandstone, and clay. There are salt-springs near the Szelon, but no use is made of them.

Manufactures and Trade.—The inhabitants excel in dressing skins and manufacturing leather; but, unlike the Russians in general, they have not a turn for mechanics, and do not willingly apply to any kind of handicraft. The countrywomen hardly spin wool and flax sufficient to manufacture linen, stockings, &c. for their own use. Some struses and barks are built, and there are many sawmills; the distilleries of brandy are few in number. There are three or four glass-furnaces. Some improvement has undoubtedly been made of late years, yet still, with the exception of Russian leather, the exportation of the government is confined to its own natural productions—rye, oats, barley, squared timber, masts, spars, planks, hemp, flax, hempseed and linseed, wool, hides, and a few other articles, which are sent to Pernau, St. Petersburg, and Narva, whence the inhabitants import colonial produce and other necessary articles.

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* Sic in orig.

* A very flat river boat, for the conveyance of timber, straw, &c. On the Wolga they are very large, have masts erected on them and have oars and a sail.

† The chetwert, according to Kelly (*Cambist*), is nearly 6 bushels (5·96).

Religion and Education.—The great majority of the inhabitants are Russians of the orthodox Greek religion. In the north-east part of the government there are a few Finns, in the western circles some Livonians, and near the chief town a colony of Esthonians, who, except that they retain their own dialect, are quite blended with the Russians, and have even embraced the Greek religion. There are also many Germans in the towns. The Greek church is under an archbishop, who has 450 churches, nine of which are cathedrals, and eight monks' and three nuns' convents in his diocese. In 1776 there were only 299 churches. Education is at an extremely low ebb in this government. According to Schmidtlin, in 1835, there were only 41 schools, with 47 masters, and 1248 scholars, besides seven schools belonging to the clergy, with 24 masters and 870 scholars; in all 2110 scholars—one to 300 of the population; and there was only one printing-office, which belonged to the crown. This statement however was given in 1832; and though we have no later detailed official statement, it is certain that considerable improvement has since been made.

The government is divided into eight circles, those of Pskow, Porkhow, Ostrow, Nowershow, Opotschka, Welikaja-Luki, Toropez, and Kholm.

Pskow, the capital of the government, is in 57° 40′ N. lat. and 28° 10′ E. long., on the left bank of the Welikaja, nearly five miles from its mouth in Lake Pskow. This town has acted a conspicuous part in the history of Russia. It is said to have been founded in the tenth century by the grand-duchess Olga. It appears to have been at first surrounded with a rampart of earth, and in the thirteenth century with a stone wall. At present the interior of the city has some resemblance to that of Moscow. In the centre of the town is the Kremlin, on the steep left bank of the river, which was erected by the brave Prince Dowmont, who reigned from 1266 to 1299, whose remains are deposited in the antient cathedral, where his sword is preserved, with the inscription, 'Honorem meum nomini dabo.' The middle town, extending in the form of a semicircle about the citadel, is also surrounded with a wall; a third very high and strong wall, five miles in extent, defends the great town, which envelopes the middle town. The fortifications, erected in 1701, by Peter the Great, have almost entirely disappeared. There is also a large suburb. Pskow must have been formerly a very populous city, if it is true that, in 1466, 48,000 inhabitants were carried off by the plague. It has sustained several memorable sieges, among others, in 1614, when it was attacked without success by Gustavus Adolphus, king of Sweden.

Pskow has sadly declined from its antient power and greatness, but is still a large town; it has one cathedral, richly adorned with gilding and carved-work, fifty-nine other Greek churches, in not more than half of which divine service is performed, a Lutheran church, three monasteries, an ecclesiastical seminary, a gymnasium, a district and other schools, an orphan asylum, and a handsome building for the government offices. It is the see of the Greek archbishop, and the residence of the military governor. The present population is 12,000, who manufacture Russia leather, linen, sail cloth, and glass.

Toropetz, the chief town of the circle of the same name, has, according to Hassel, Hörschelmann, and others, a population of 12,000, but Schmidtlin says that it does not exceed 7500. It is an antient town, extremely well situated for carrying on an extensive trade, communicating with Riga by means of the river Toropa, on which it is situated, and which joins the Düna. There are thirteen churches and two convents in the town. Most of the houses are of wood.

The Germans call this government Pleskow or Pleskau, which is probably the right name, and the most antient that the town bore, for the historian Cedrenus calls it Pliscoba.

(Hassel; Stein; Hörschelmann; Schmidtlin, *La Russe et la Pologne;* and Russian official journals.)

PSO'PHIA. [Agami, in which article the scientific name of the bird is erroneously spelled *Trophia.*]

Mr. Swainson places the form in his family *Megapodinæ* (*Megapodiidæ*), between the *Dicholophus* and *Crax*. [Megapodiidæ.]

Mr. G. R. Gray arranges *Psophia* under his family *Ardeidæ*, in the subfamily *Psophinæ*, which consists of that genus and *Cariama* (*Dicholophus*, Ill.) only.

PSORA. [Itch.]

PSORA'LEA (so called from the Greek psoraleos (ψωραλέος), *warted*, on account of most of the species being covered with little tubercles), a genus of Papilionaceæ, of the natural family of Leguminosæ, characterised by the tube of the permanent calyx being sprinkled with callous points. Sepals five, united to the middle; stamens ten, usually diadelphous. Legume indehiscent, one-seeded, sometimes ending in a beak. Leaves of various forms. Flowers blue, white, or purple. The species, about sixty in number, and natives of different parts of the world, are either herbaceous plants or low shrubs, some of them ornamental, and all of easy culture. They may be propagated either by cuttings or seeds, which they produce abundantly. *P. esculenta*, the bread-root of North America, is cultivated along the banks of the Missouri and in other parts of that country. The roots, which abound in farinaceous matter, are, like the tubers of the potato, employed as food, especially during the winter months. In this climate it will grow in the open air, but requires the protection of a frame to produce abundant crops of roots. P. corylifolia is diffused over every part of India, especially in the vicinity of villages, during the rainy and cold seasons. It is employed as stomachic and deobstruent. Other species are also used medicinally. P. glandulosa is called in Chili, coulen, culen, or cullen. Some of the native tribes make a very intoxicating kind of beer from a variety called yellow cullen.

PSORI'ASIS is a disease of the skin distinguished by slightly raised red patches of various extent and form, and generally covered with whitish scales. Several varieties of the disease have received different names, according to the form and severity of the eruption in each, and many others, according to the part chiefly or alone affected. The former varieties are Psoriasis guttata, P. diffusa, P. gyrata, and P. inveterata; among the latter are P. ophthalmica, P. palmaria, &c.

Psoriasis guttata is a mild form of the disease, consisting of small red patches two or three lines in diameter covered with very fine white scales. It occurs in various extent on all parts of the body, but most rarely on the face. At first small red spots appear, and soon after present white scales at their centres; then the spots gradually enlarge and the scales increase in number, till the redness begins to fade at the centre, and as the scales fall off, the skin slowly assumes its natural colour. The eruption is attended by a moderate itching, and by very slight symptoms of general disorder.

P. diffusa is in every respect a more severe form of the disease. The spots are large and irregular, and often confluent, and covered with thick scaly incrustations. It appears most frequently on the limbs and around the joints, often covering the whole of a limb with one scaly or raw-looking patch, and sometimes occurring at once and with equal severity on several parts of the body. The skin beneath the scales is very tender and irritable; it often cracks and discharges a thin ichor, which concretes about the fissures, and is attended by considerable pain and irritation, and some constitutional disturbance. The eruption often breaks out successively in different parts of the body, so that it is common for the disease to be protracted for several months and even for years.

P. inveterata is only (as its name implies) a yet less curable form of the same disease. The skin has its whole texture thickened and hard, its surface is covered by a furfuraceous deposit, and in the neighbourhood of the joints it is often very deeply and painfully cracked. The preceding forms are commonly met with in those who are otherwise in pretty good health; but this rarely occurs, except in those whose constitutions are enfeebled by long disease or want.

P. gyrata is a slight but very rare variety, distinguished by the patches occurring in stripes of a singularly tortuous or serpentine form.

Of the local varieties of Psoriasis, the most interesting is that which occurs on the palms of the hands, and which, being most frequent in those who work with light powders and other irritating substances, is commonly called bakers', or bricklayers', or washerwomen's itch.

Psoriasis, in all its forms, is difficult of cure. The general condition of the health being corrected by the means that in each case seem appropriate, the remedy which is most frequently successful in cases of long standing is arsenic, in the form of from three to five drops of the Fowler's solution, three times a day, for an adult. Active purging is also often useful, especially in recent cases and in young subjects. Another good remedy is tincture of cantharides, in doses of from three to five drops (for an adult) in water once or more in the day; but the effects of both this and the arsenic require to be carefully watched during their administration, and they must be discontinued as soon as they appear to produce any sickness or heat in the stomach. In addition to these, various other internal means have been recommended, and sometimes found useful, as decoctions of dulcamara, mezereon, and orchis, antimony, sulphur, &c. Indeed, in many cases it is found necessary to try one means after another without any rule, till one is found which produces benefit. External remedies are generally of less value than internal. The most approved are vapour and sulphur baths, and ointments or lotions containing very small quantities of nitrate of mercury, or white precipitate, or kreasote, or alkalis. These however can only be employed in the later stages of the disease: in the earlier, the mildest fomentations give relief, and all kinds of irritants must be carefully avoided.

PSYCHE (Ψυχή). Apuleius is the first writer who relates the loves of Cupid and Psyche (*Metamorph.*, lib. iv., v.). According to his account, Psyche was the most lovely creature that the world ever beheld. People flocked from all parts to see her, and neglected the worship of Venus, who became in consequence so incensed against her, that she commanded her son to inspire Psyche with love for some vile creature. Cupid however, instead of obeying the commands of his mother, became enamoured with Psyche, and made her his wife. She was however subsequently deserted by him for disobeying certain injunctions which he had given her. Inconsolable at her loss, she wandered through the world in search of him, and after enduring many trials and sorrows, was at length united to him. Jupiter conferred upon her immortality, and her union with Cupid took place with the approbation of Venus and the other deities. A child was soon afterwards born to them, who was called Pleasure.

Many writers consider the above tale an allegory, representing the union between the divine love and the human soul. The word Psyche signifies in Greek both 'soul' and a 'butterfly.' We frequently find in antient works of art Cupid pressing Psyche to his bosom in the form of a butterfly. It is thought by some modern writers that Psyche, or the soul, was personified in the form of a butterfly in the earlier representations of the allegory. When Psyche is represented with a human form, the wings of the butterfly are usually placed on her shoulders.

Though Apuleius is the first writer who mentions the loves of Cupid and Psyche, it is supposed the tale must have been current before his time, as there are many works of art representing this subject, which appear to have been executed before the second century of the Christian æra, which was the time in which Apuleius lived. (*Brit. Museum, Townley Gallery*, vol. i. pp. 147-148, Lond. 1836.)

PSYCHO'TRIA, a name variously derived, which is applied to a rather large tropical genus of the division of the great family of Rubiaceæ which is called Cinchonaceæ. It is characterised by having a calyx 5-parted, somewhat entire; corolla regular, funnel-shaped, five (rarely four) cleft; stamens five, rarely four, exserted or included within the throat of the corolla. Stigma bifid. Berry drupaceous, crowned with the limb of the calyx, usually marked with ten ribs, and containing two nuts. Nuts ribbed; single seeded. Trees or shrubs; rarely herbaceous plants. Some of the species are ornamental in foliage, and one, *P. parasitica*, as its name indicates, is found growing on trees in the West India Islands.

Several of the species are supposed to possess considerable medicinal properties. *P. emetica* is a small under-shrub, a native of New Granada on the banks of the Magdalena, and probably of other parts of South America; the *Cephælis emetica* of some other authors. The stem is erect, simple, hairy, and tomentose; leaves oblong, acuminate, narrow at the base, membranous, ciliate, rather hairy on the under surface; stipules very short, ovate, acuminate; peduncles few-flowered, axillary, sub-racemose. This species has long been celebrated as yielding the black or Peruvian or striated ipecacuanha, which, analysed by Pelletier, gave of emetine 6, fatty matter 2, and of starch and ligneous matter, the latter bearing but a small proportion, 92. P. herbacea is an Indian species used for the same purposes. The roots of *P. sulphurea* and of *P. tinctoria* are employed in dyeing.

PSYCHRISTUS, JACO'BUS (Ἰάκωβος Ψύχριστος), a celebrated physician of the fifth century. 'He was very eminent,' says Freind (*Hist. of Physic*), 'for his great insight into philosophy and physic, which he learned from his father Hesychius (who was also a physician), and who had travelled into a great many countries in the pursuit of knowledge. He was made count and archiater to Leo the Great, or the Thracian (who reigned from A.D. 457 to 474), and was so much beloved by this emperor and the people, that the senate set up a statue for him in the baths of Zeuxippus, built by Severus. (Malelas *in Vitâ Leonis*.) Isidore of Gaza, called by others the Pelusiote, who flourished in the time of Justinian, saw another erected to him at Athens. (Photius, § 559.) And this author gives a further account of him, that he was an Alexandrian, though his family was originally derived from Damascus; that he had great experience in physic, and did many wonderful cures; that in his practice he frequently ordered clysters and suppositories; that in surgery he seldom made use of fire or the knife, and was no friend to bleeding. He was preferred to all the modern physicians by his scholar Asclepiodotus, who grew famous for reviving the use of white hellebore, which in that time had grown quite out of vogue, and was not so much as known to Jacobus himself. Suidas is still larger in his praise of this Jacobus, and says he attained to a perfect knowledge in physic, both in theory and practice: that he excelled all his contemporaries, that he might be compared to the antients, and was superior to many of them. that he was beloved and adored by his patients, who thought him inspired by heaven; that they had an implicit faith in him, because they never found his prognostic fail. Such an eagerness had he for improving his own art, that they thought the soul of Æsculapius was transfused into him. Kuster tells us he has retrieved his true name Ψύχριστος out of Malelas, whereas in the former editions of Suidas it was printed Ψυχόχριστος; however, in the translation of Aëtius (*Tetrab.*, iii., Serm. 4, cap. 43, col. 608), we read Psychristus. But I have reason to believe that both these readings are wrong; and if we consult Alexander Trallianus, we shall plainly discover that it ought to be read Ψυχόχρηστος or Ψυχρόχρηστος (for it may be either), as Φιλόχρηστος for he says in express terms that this name was applied to him, ὅτι ὑγραινούσῃ τροφῇ ἐκέχρητο (lib. v., cap. 4, p. 249, ed. Basil). Alexander gives him the epithet of θεοφιλέστατος, and Suidas, after him, calls him θεοφιλὴς: and therefore there must be an error in the text of Photius, where he and his father it is said ἀσεβέε ἤσθην: and whoever attends to what follows in Photius, will perceive it ought to be read εὐσεβεῖ.' To this account by Freind, it should be added that (apparently to increase his influence over his patients) he pretended to be able to divine their thoughts as well as to distinguish their diseases. Some of his medical preparations are preserved by Alexander Trallianus (pp. 645, 649), but he does not appear to have left any works behind him. (See also Kühn, *Additam. ad Elench. Medicor. Veterum à J. A. Fabricio in Bibl. Gr. Exhibitum*, 4to., Lips., 1838, Fascic. xvii.)

PSYLLA (Geoffroy), a genus of insects belonging to the family *Aphidæ*, which, according to Latreille, forms the second family of the Homopterous *Hemiptera*.

The Psyllæ are minute insects, allied to those commonly called plant-lice, and live upon trees and plants, from which they derive their nutriment by suction, and in so doing they often produce excrescences somewhat resembling gall-nuts, particularly on their leaves and buds. They have two joints to the tarsi; the antennæ are composed of ten or eleven joints, the last of which have two bristles; both sexes have wings, and they possess the faculty of leaping. Their larvæ usually have a very flat body, broad head, and the abdomen rounded behind: the legs are terminated by a little membranous vesicle accompanied beneath with two hooks. Four wide and flat pieces, which are the sheaths of the wing distinguish the pupa state; several of the species in this stage, as well as in the larva state, are covered with a white substance resembling cotton. The species are very numerous, and are often named after the plants which they infest. Mr. Stephens records twenty-six species as natives of this country.

PSY'LLIUM, a name of a plant which occurs in Dioscorides, &c., supposed to be so named from Psyllus (ψύλλος), a flea, from the resemblance of the seeds to that insect. The plant, Plantago Psyllium of botanists, is common in the south of France; its seeds are small, oblong and flattish, smooth, slippery, and shining, abounding in mucilaginous matter; whence their decoction is employed as a demulcent, and for many of the same purposes as linseed tea is in this country. They are also employed by the manufacturers of muslins, and hence form an article of commerce in the south of France. It is remarkable, according to Dr. Royle, that in the Eastern countries, where translations of Dioscorides continue to be employed for the description of medicinal plants and drugs, the seeds of another species of Plantago, the *P. Ispaghula* of Roxburgh (from the Persian Ispagool), should be employed for and considered identical with the *fuslioon*, that is, the psyllium of the Greeks.

PTARMIGAN. [Tetraonidæ.]

PTEROCARPUS (from *πτερὸν, a wing*, and *καρπὸς, fruit*, from its pod being winged), a genus of the natural order of Leguminosæ, containing many plants valuable for the nature of their products, and all of which are found indigenous in the tropical parts both of the Old and New World. The calyx is 5-cleft, corolla papilionaceous, stamens 10, ovary long-stalked. Legume indehiscent, irregular, somewhat orbicular, surrounded with a wing, often rugose, and 1-seeded. The species are about 20 in number, forming trees or shrubs. Leaves unequally pinnate, with the inflorescence in axillary racemes or forming terminal panicles. Many of the species, as P. dalbergioides, Marsupium, Indicum, and Santalinum, afford excellent timber; some, as the bark of P. flavus, are employed in dyeing; and others are thought to possess medicinal properties.

P. dalbergioides is a native of the Andaman Islands, where it grows to an immense size, and forms a valuable timber-tree, of which the wood is known as Andaman red wood, from its resemblance to mahogany; but it is redder, heavier, and coarser grained, though that of the root is finer than that of the stem. It was introduced by Col. Kyd into the Calcutta botanic garden in 1794, whence it has been spread into the country. *P. Santalinus*, or three-leaved Pterocarpus, is a native of India, which yields the Red Sandal or Red Saunder's wood of commerce, a substance long known for its employment in medicine, being described in the works of the Arabs under the name of *sundroos*. The tree is distinguished by having the three leaflets roundish, retuse, and glabrous. Racemes axillary, simple, or branched. Stamens triadelphus (5, 4, and 1). The wood from the centre of the tree is imported in large billets, which, when fresh, are of a brilliant red colour, but which gradually deepens by exposure to air, so that the outside becomes blackish-coloured. It is insipid, inodorous, and *takes a fine polish, and may be distinguished from Brazil wood by the latter yielding its colour to water alone, whilst the red-sandal wood barely tinges it.*

Many of these trees exude a reddish-coloured juice which hardens into a kind of astringent gum. The name of dragon's blood has been applied to that from P. Draco, a native of South America and the West India islands, as well as to the similar product of several other trees, while that of P. erinaceus has long been considered to be the real Kino of the west coast of Africa.

This substance seems to have been first mentioned by Moon, in his travels into the interior of Africa, as quoted by Murray, 'App. Med.,' vi., p. 202, as a red gum issuing from incisions in trees, which he mistook for dragon's blood. Dr. Fothergill introduced this into British practice in 1757, having been first indebted to Dr. Oldfield for information respecting its virtues. The red astringent gum, or Kino, as it was called, was said to have been procured out of a ship from the coast of Africa. Mungo Park discovered a tree, which he found called *pao de sangue* by the Portuguese, on the coast of Senegal, and which was afterwards ascertained to be P. erinaceus of Lamarck. Substitutes were early introduced for this substance, so that doubts may be entertained respecting what was originally employed, as the name Kino is so similar to the Sanscrit and Hindu names, *Kinsuka* and *Kuenee*, of the gum of Butea frondosa, which is, no doubt, one of the earliest substitutes for this substance. [Kino.]

P. Marsupium is another species, a native of the Circar Mountains of India, and grows to a large tree. It also exudes a red juice which hardens into a strong simply astringent gum of a dark red colour, so much resembling that of the Butea frondosa, that, according to Dr. Roxburgh, the same analysis might answer for both. [Kino.]

PTERO'CERAS. [Strombidæ.]

PTE'ROCLES. [Tetraonidæ.]

PTERODACTYLE (*Pterodactylus* of Cuvier; *Ornithocephalus* of Sömmering), a genus of fossil *Saurians*, whose type is entirely extinct.

To Collini, the director of the elector-palatine at Mannheim, we are indebted for the first introduction of this Heteroclite. He described the skeleton of the long-billed species from a specimen, found at Aichstädt near Solenhofen, in that Museum, and figured it in the 'Memoirs of the Palatine Academy' (Part. Phys., v. 58, et seq.).

Collini had well made out the head, the neck, the retrograde direction of the trunk, the small tail, the left leg, and the two arms; but beyond this he seems to have been at a loss. He came to the conclusion that the animal was neither a bird nor a bat; inquired whether it might not be some amphibian; and finished by expressing his opinion that the type must be sought among the marine *vertebrata*.

Blumenbach took a widely different view of the subject, and referred this extraordinary form to the Palmipede or web-footed birds.

Professor Hermann of Strasburg, who drew upon his imagination for a restoration of the animal, and clothed it in a hairy skin, considered it to be a mammal, and assigned to it a situation between the mammiferous class and birds, still more intermediate than that occupied by the bats.

Sömmering also arranged the form among the mammals, in the neighbourhood of the bats, not without an elaborate detail of the reasons which had conducted him to that conclusion.

It was reserved for the penetrating eye and acute but patient investigation of Cuvier effectually to destroy these theories, supported though they were by weighty authorities: the satisfactory reasoning by which he disposes of them one after the other, and proves conclusively from the organization of the animal that it was a Saurian (in which opinion he was supported by Oken) will be found at large in the fifth volume of the last edition of his *Ossém[illegible] Fossiles*. Our limits will not permit us to detail the links of the harmonious chain of his proofs; and we must here content ourselves with observing that the form of the *os quadratum* appears to have been the principal key by which the great French naturalist solved this intricate zoological puzzle, and detected its Saurian character. 'Behold,' says he, after having built, as it were, the animal before our eyes, 'an animal which, in its osteology, from its teeth to the end of its claws, offers all the characters of the Saurians; nor can we doubt that those characters existed in its integuments and soft parts—in its scales, its circulation, its generative organs. But it was at the same time an animal provided with the means of flight,—which, when stationary, could not have made much use of its anterior extremities, even if it did not keep them always folded as birds keep their wings,—which nevertheless might use its small anterior fingers to suspend itself from the branches of trees, but when at rest must have been ordinarily on its hind feet, like the birds again; and, also like them, must have carried its neck sub-erect and curved backwards, so that its enormous head should not interrupt its equilibrium.'

Well may Cuvier remark, that of all the beings whose antient existence is revealed to us in his great work above alluded to, these Pterodactyles are the most extraordinary; and that if we could see them alive, they would be the most at variance with living forms. Their flight was not performed by means of ribs as in the dragons [Dragon]; nor by means of a wing without distinct fingers, like that of a bird; nor by a wing leaving the thumb alone at liberty, as in the bats; but by a wing sustained principally on one very elongated finger, whilst the rest preserved their ordinary brevity and their claws. At the same time these flying reptiles—a denomination almost contradictory—have a long neck, the bill of a bird, everything in short that could conduce to give them a strange aspect. (*Oss. Foss.*)

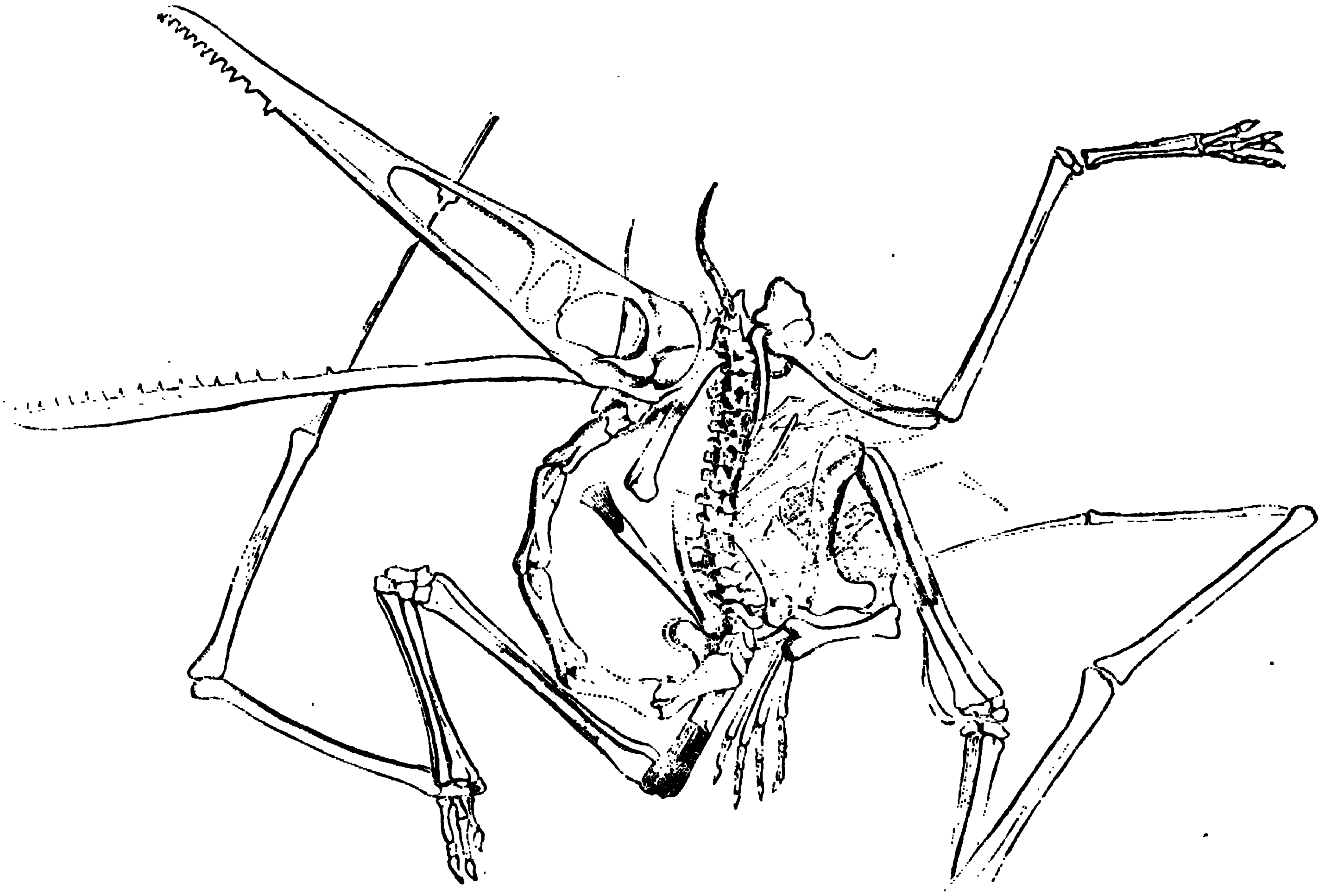
Dr. Buckland (*Bridgewater Treatise*) ranks these flying reptiles among the most remarkable disclosures made by geology, and considers them as presenting more singular combinations of form than we find in any other creatures yet discovered amid the ruins of the antient earth. He calls attention to the extraordinary discordance of opinion respecting a creature whose skeleton was almost entire, and observes that this discordance arose from the presence of characters apparently belonging to each of the three classes to which it was referred; the form of its head and length of the neck resembling that of birds, its wings approaching to the proportion and form of those of bats, and the body and tail approximating to that of ordinary mammalia. These characters, connected with a small skull, as is usual among reptiles, and a beak furnished with not less than sixty pointed teeth, presented, he remarks, a combination of apparent anomolies, which the genius of Cuvier reconciled. 'In his hands,' says the Professor, in continuation, 'this apparently monstrous production of the antient world has been converted into one of the most beautiful examples yet afforded by comparative anatomy, of the harmony that pervades all nature in the adaptation of the same parts of the animal frame to infinitely varied conditions of existence. In the case of the Pterodactyle, we have an extinct genus of the order Saurians, in the class of Reptiles (a class that now moves only on land or in the water), adapted by a peculiarity of structure to fly in the air. It will be interesting to see how the anterior extremity, which in the fore-leg of the modern lizard and crocodiles is an organ of locomotion on land, became converted into a membraniferous wing; and how far the other parts of the body are modified so as to fit the entire animal-machine for the functions of flight. The details of this inquiry will afford striking examples of numerical agreement, in the component bones of every limb, with those in the corresponding limbs of living lizards, and are at the same time illustrative of contrivances for the adjustment of the same organ to effect different ends.'

Dr. Buckland observes that we are already acquainted with eight species, varying from the size of a snipe to that of a cormorant.

Hermann von Meyer enumerates the following named species:—

1. *Pterodactylus longirostris*, Cuv. (*Ornithocephalus longirostris*, Sömm.; *Pterodactylus crocodilocephaloïdes*, Ritgen).

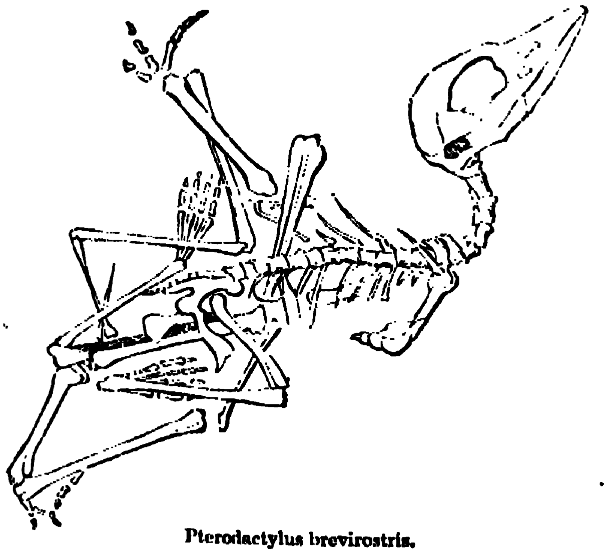
Locality, Solenhofen. (About the size of a woodcock.)



Pterodactylus longirostris.

2. *Pterodactylus brevirostris*, Cuv. (*Ornithocephalus brevirostris*, Sömm.; *Pterodactylus nettecephaloïdes*, Ritgen).

Locality, Solenhofen.



Pterodactylus brevirostris.

3. *Pterodactylus crassirostris*, Goldf.

Locality, Solenhofen.

4. *Pterodactylus medius*, Münster.

Locality, Solenhofen.

5. *Pterodactylus Münsteri*, Goldf.

Locality, Solenhofen.

6. *Pterodactylus Macronyx*, Buckland (*Ornithocephalus Banthensis*, Theodori).

Localities, Lyme Regis, Buckl.: *Banz* (Germany), H. von Meyer. (Size about that of a raven; wings, when expanded, about four feet from tip to tip.)

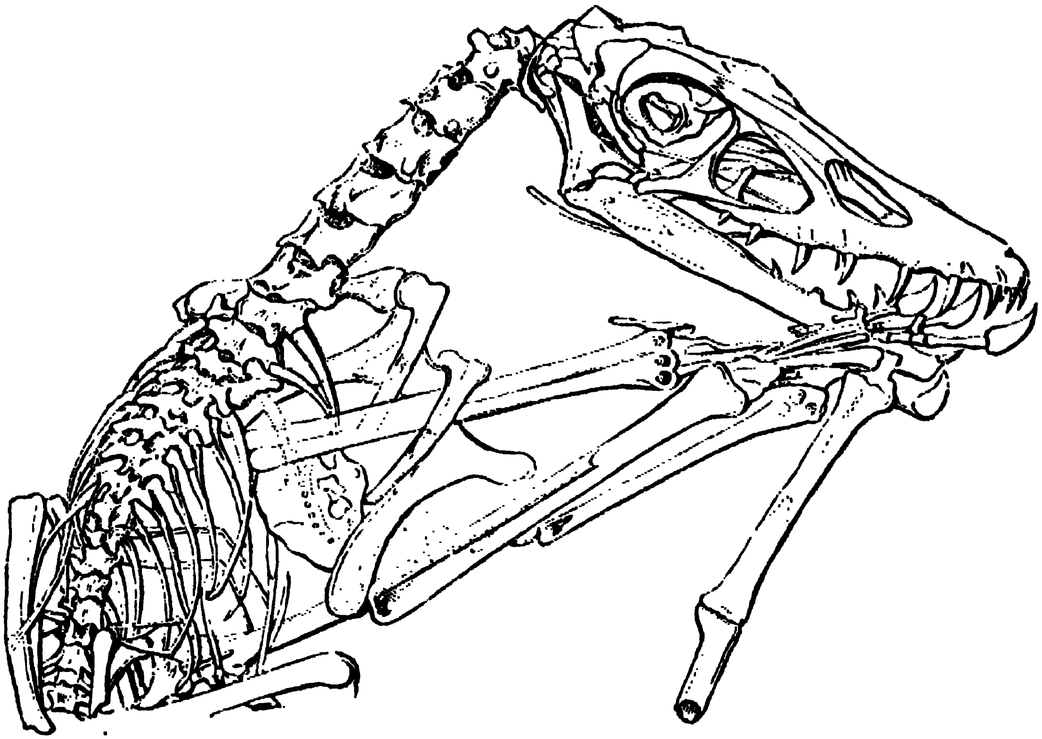
7. *Pterodactylus grandis*, Cuv. (*Ornithocephalus giganteus*, Sömm.).

Locality. Solenhofen? (About four times as large as *Pt. longirostris*.)

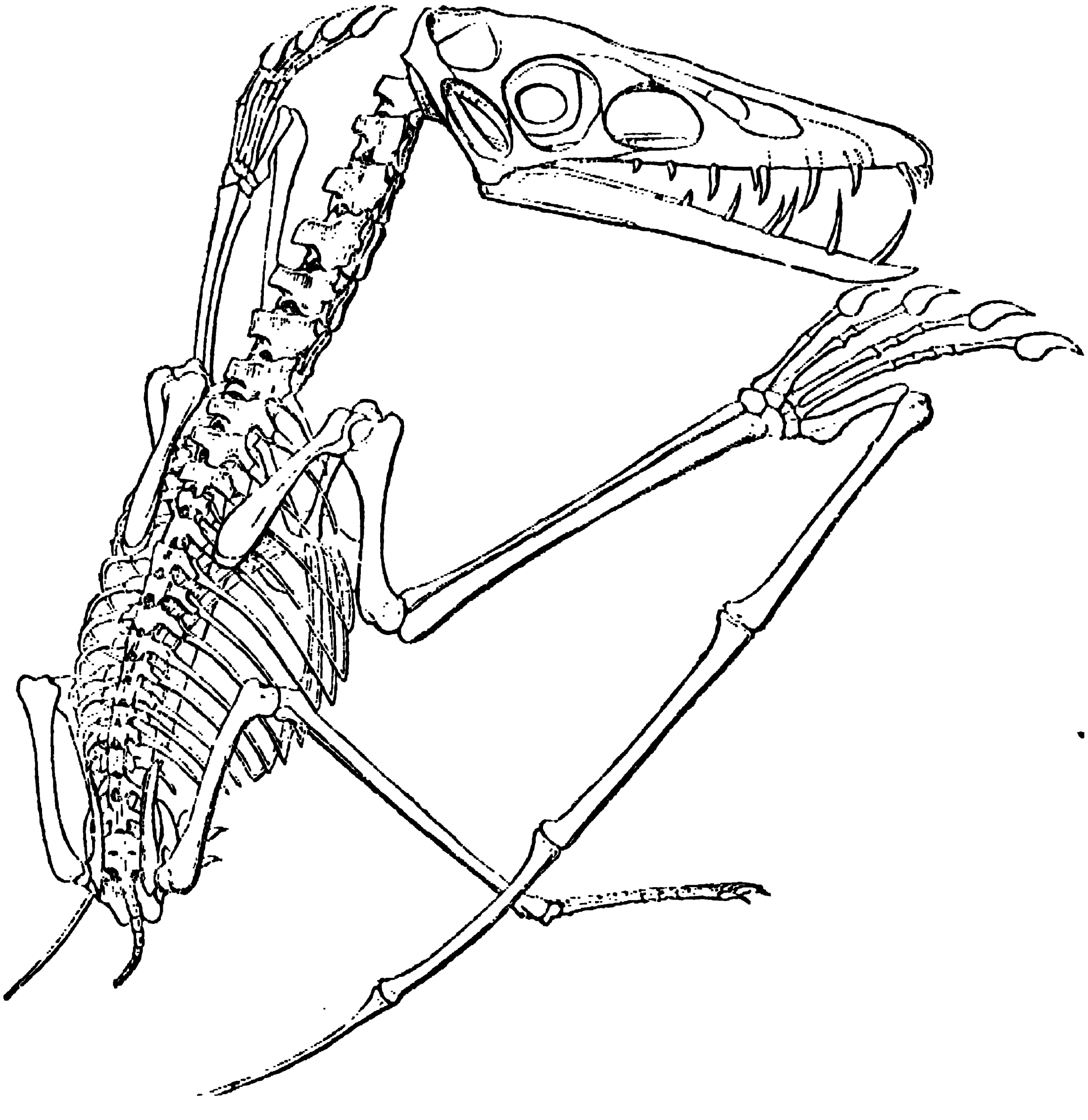
8. *Pterodactylus Bucklandi*, Goldf.

Locality, Stonesfield.

Dr. Buckland remarks that in *Pterodactylus Macronyx* (lias at Lyme Regis) there is an unusual provision for giving support and movement to a large head at the extremity of a long neck, by the occurrence of bony tendons running parallel to the cervical vertebræ, like the tendons that pass along the back of the Pigmy Musk (*Moschus pygmæus*) and of many birds. This provision, he observes, does not occur in any modern Lizards, whose necks are short, and require no such aid to support the head. In the compensation which these tendons afforded for the weakness arising from the elongation of the neck, Dr. Buckland sees an example of the same mechanism in an extinct order of the most antient reptiles, which is still applied to strengthen



Pterodactylus crassirostris. (Goldf.)



Pterodactylus crassirostris, restored. (Goldf.)

other parts of the vertebral column in a few existing species of *Mammalia* and birds.

The same author points out that the three first fingers of the Pterodactyle agree in structure with those of the fore-foot of living Lizards; but as the hand of the fossil reptile was to be converted into an organ of flight, the joints of the fourth or fifth finger were lengthened to become expansors of a membranous wing. Thus in *Pt. longirostris*, he observes, the fourth finger is stated by Cuvier to have four elongated joints, and the fifth or ungueal joint to be omitted, as its presence is unnecessary. In the *Pt. crassirostris*, according to Goldfuss, this claw is present upon the fourth finger, which thus has five bones, and the fifth finger is elongated to carry the wing. Throughout all these arrangements in the fore foot the normal numbers of the type of Lizards are maintained. 'If,' continues Dr. Buckland, 'as appears from the specimen engraved by Goldfuss, of *Pt. crassirostris*, the fifth finger was elongated to expand the wing, we should infer, from the normal number of joints in the fifth finger of Lizards being only three, that this wing-finger had but three joints. In the fossil itself the two first joints only are preserved, so that his conjectural addition of a fourth joint to the fifth finger in the restored figure, seems inconsistent with the analogies that pervade the structure of this and of every other species of Pterodactyle, as described by Cuvier. According to Goldfuss, this species had one more toe than Cuvier assigns to the other species; in this respect it is so far from violating the analogies we are considering, that it adds another approximation to the character of the living Lizards.' After referring to the difference manifested in *Pt. crassirostris* from the other Pterodactyles, in having the fifth instead of the fourth finger elongated, as above noticed, for the purpose of expanding the wing, Dr. Buckland states that it is however probable that the fifth toe had only three joints, for the same reasons that are assigned respecting the number of joints in the fifth finger; and he observes that in *Pt. longirostris*, Cuvier considers the small bone in the foot to be a rudimentary form of a fifth toe.

Geological Position.—Lithographic limestone of the Jura formation at Aichstädt and Solenhofen, which abounds with remains of fish, and of brachyurous and macrurous crustaceans, and where *Xiphosuri* (*Limulus*) not unfrequently occur. The fish examined by Cuvier belonged, partially at least, to marine genera. He distinguished, for example, a well characterised species of anchovy, probably *Clupea sprattiformis*, Bl. *Libellulæ* and other insects have also been found in this Solenhofen slate. The other localities are Lyme Regis (lias), Bantz, and Stonesfield (oolite).

Habits, Food, &c.—Cuvier, speaking of the Solenhofen district, observes that there is no doubt that at the time of the deposit of the lithographic slate, there lived in that canton crocodiles, *Limuli*, and other beings whose geographical distribution is now confined to the torrid zone,[*] together with these flying Saurians, which flitted about by means of the membrane sustained by a single finger, suspended themselves and perhaps crept by the aid of the other three fingers, stood upon their hind legs only, and had their enormous gape armed with small pointed teeth, fit only for seizing insects and small animals.

Dr. Buckland thinks it probable that the Pterodactyle had the power of swimming so common in reptiles, and now possessed by the Vampire Bat[†] of the island of Bonin. (*Bridgewater Treatise.*) 'Thus,' says the Professor, 'like Milton's fiend, all qualified for all services and all elements, the creature was a fit companion for the kindred reptiles that swarmed in the seas or crawled on the shores of a turbulent planet:

> "The Fiend
> O'er bog, or steep, through strait, rough, dense, or rare,
> With head, hands, wings, or feet, pursues his way,
> And swims, or sinks, or wades, or creeps, or flies."

With flocks of such-like creatures flying in the air, and shoals of no less monstrous Ichthyosauri and Plesiosauri swarming in the ocean, and gigantic crocodiles and tortoises crawling on the shores of the primeval lakes and rivers, air, sea, and land must have been strangely tenanted in these early periods of our infant world.' (*Geol. Trans., N. S.*, iii., part 1.)

In the 'Bridgewater Treatise' we find the size and form of the foot, and also of the leg and thigh, adduced as showing that the Pterodactyles had the power of standing firmly on the ground, where, with their wings folded, they possibly moved after the manner of birds; and an opinion that they could also perch on trees, and climb on rocks and cliffs, with their hind and fore feet conjointly, like Bats and Lizards.

Cuvier, as we have seen, conjectured that the food of these flying Saurians consisted of insects and other small animals, and he thought that, from the magnitude of their eyes, they may have been also noctivagous. Dr. Buckland refers to the presence of large fossil *Libellulæ*, or Dragonflies, together with many other insects in the same quarries with the Solenhofen Pterodactyles, and to the occurrence of the wings of coleopterous insects, mingled with the bones of those Saurians in the oolitic slate at Stonesfield, as proof that large insects existed at the same time with them, and that they may have contributed to their supply of food. He adds however that the head and teeth of two species of Pterodactyle are so much greater and stronger than is necessary for the capture of insects, that the larger species of them may possibly have fed on fishes, darting upon the latter from the air, after the manner of Sea-Swallows, or Terns, and Solan Geese. The enormous size and strength of *Pt. crassirostris*, he observes, would not only have enabled it to catch fish, but also to kill and devour the few small marsupial mammalia which then existed upon the land.

PTERODI'CTYUM. [Polypiaria.]

PTEROGLOSSUS. [Ramphastidæ.]

PTEROLO'BIUM, a small genus of plants of the natural family of Leguminosæ, so named from its pod ending in a membranous wing. The genus was first mentioned by Mr. Brown, in the appendix to Salt's 'Travels in Abyssinia,' and from a species, the Kantuffa, which is also named by Bruce, and described by him as being ordered to be cut away from the roads when the king was going to travel. The genus is found in India as well as in Africa, and even the species Kantuffa occurs there, as it is the Cæsalpinia lacerans of Roxburgh, but referred to Mimosa by De Candolle, and called *M. Kantuffa*; having been ascertained to be identical with the Indian plant, and belonging to this genus, it has been called Pterolobium lacerans. The genus contains only a few species of trees and climbing shrubs covered with strong sharp hooked prickles.

PTE'ROMYS. [Sciuridæ.]

PTEROPLEURA. [Gecko, vol. xi., p. 105.]

PTERO'PODA, Cuvier's tenth class of Mollusks, *Aporobranchiata* of M. De Blainville, who divides the order into the *Thecosomes* and *Gymnosomes*.

Cuvier defines his *Pteropoda* to be mollusks which swim like the cephalopods in the sea, but are unable to fix themselves, or creep there, from the want of feet. Their organs of motion consist only of fins, placed like wings at the two sides of the mouth, and they are stated to be all hermaphrodites.

The following genera compose Cuvier's *Pteropoda*:—

1. *Clio.* [Clio.] 2. *Cymbulia.* [Hyalæidæ, xii., p. 371.] 3. *Pneumodermon.* [Clio, vol. vii., p. 266.] 4. *Limacina.* [Hyalæidæ, vol. xii., p. 372.] 5. *Hyalæa.* [Hyalæidæ, vol. xii., p. 372.] 6. *Cleodora.* [Hyalæidæ, vol. xii., p. 373.] and 7. *Pyrgo*, described as a very small fossil shell, discovered by Defrance, globular, very delicate, and divided by a very narrow transversal slit. [Thecosomata.]

PTERO'PTOCHUS. [Merulidæ, vol. xv., p. 123.]

PTE'ROPUS. [Cheiroptera, vol. vii., p. 26.]

PTEROSOMA'TIDÆ. [Nudibranchiata, vol. xvi., p. 360.]

PTEROSPERMUM (from the Greek word signifying a wing, and σπέρμα, a seed), a small genus of plants of the natural family of Byttneriaceæ, which is found in the Indian isles and the southern parts of India. The flowers being large and the foliage showy, have induced the cultivation of the species as ornamental trees all over India. The calyx is leathery, five-partite, tomentose outside, hairy within. Petals five, shorter than the calyx. Stamens twenty (five sterile), united at the base into a column with the stalk of the ovary. Style slender, club-shaped. Seeds winged. The genus is small, but all the species form handsome trees, and, like most of the plants of the nearly allied order of Malvaceæ, abound in mucilage.

PTEROTRA'CHEA. [Gasteropoda, vol. xi., p. 92; Nucleobranchiata; Atlanta; Carinaria.]

PTERU'THIUS. [Leiotrichanæ.]

PTILOCHLO'RIS. [Vireoninæ.]

PTILO'GONYS. [Shrikes.]

PTILOLEPTUS. [Indicatorinæ, vol. xii., p. 459.]

PTI'LONOPUS. [Columbidæ, vol. vii., p. 368.]

PTILONORHY'NCHUS. [Sturnidæ.]

PTILO'PACHUS, Mr. Swainson's name for a subgenus of rasorial birds placed by him under the genus *Perdix* in the family *Tetraonidæ*.

Generic Character.—*Bill* small, slender. *Nostrils* naked, very large, occupying one half of the length of the bill. *Wings* rounded. *Tail* broad, rounded, larger and longer than in *Perdix*; the feathers very soft. Feathers of the back and rump with the shafts thickened and apparently spinous, as in *Ceblepyris*. *Tarsus* shorter than the middle toe. Lateral toes nearly equal, claws considerably compressed. (Sw.)

Geographical Distribution of the Genus.—Africa and India. (Sw.)

Example, *Ptilopachus erythrorhynchus*.

Description.—Size intermediate between the quail and the partridge. Ground-colour of the whole plumage earth-brown, just as dark on the body as on the back; this colour is varied by dusky white spots in the following manner:—the feathers upon the neck, throat, breast, interscapulars, and sides of the body have a row of white stripes down the middle of each web, bordering a stripe of rufous which occupies the middle of each feather; these spots (which are most distinct and defined on the interscapulars and sides of the body) are bordered above by a line of obscure black; the spots become indistinct and run into each other on the breast so as to form stripes. The chin and part of the throat is dirty white, each feather being nearly black in the middle. On the fore part of the body, immediately beneath the breast, is a large patch of pale fulvous or buff-yellow. All the rest of the plumage is dark brown, without any other variation than very minute and scarcely perceptible freckles of a paler colour; the quill and tail feathers are without any bands or spots, but there are a few white dots on the wing-covers, and obsolete undulations on the flanks; bill, orbits, and legs light, probably red in the live bird; tail very broad and rounded. Total length about ten inches. (Sw., *Birds of West Africa*, in 'Nat. Lib.') [Perdicidæ, vol. xvii., p. 443.)

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[*] A fine species of *Limulus* has been taken near Boston, in North America.

[†] Bonin Roussette (*Pteropus*).

PTILO'PHYRUS, Mr. Swainson's name for the genus *Lophyrus* [Columbidæ, vol. vii., p. 370], a change which he proposes because *Lophyrus* was preoccupied to designate a genus of insects.

PTI'LORIS, Mr. Swainson's name for a genus of birds which he arranges under the *Paradisiadæ*, or *Birds of Paradise*.

Generic Character.—*Bill* greatly curved. *Nostrils* basal, plumed; the aperture linear. *Wings* rounded. Tail short, even. *Tarsi* short. *Toes* as in *Meliphaga;* hallux very strong, equal to the tarsus and to the middle toe. Soles flat and broad. (Sw.)

Example, *Ptiloris Paradiseus* (*Rifle Bird*).

Locality.—New Holland.

PTILO'STOMUS, Mr. Swainson's name for a genus of birds which he places under the subfamily *Glaucopinæ* (Wattle-Crows) of the family *Corvidæ*.

Generic Character.—*Bill* shorter than the head, much compressed, the culmen considerably arched, and curved from the base. *Rictus* bristled. *Wings* moderate, slightly rounded; the third, fourth, and fifth quills longest. *Tail* long, cuneated; the feathers lanceolate. *Feet* very strong and robust. *Tarsus* lengthened, longer than the middle toe and claw; lateral toes short, and of equal length. (Sw.)

Geographical Distribution of the Genus.—Africa.

Example, *Ptilostomus Senegalensis* (Sw.), *Senegal Piapec*.

Description.—Size smaller and general form more slender than in the European magpie. Plumage of body above and below sooty black, feathers very soft and silky, and with a soft gloss upon them. On the tertials, and some of the secondaries, close transverse bands of darkly shaded lines, similar to those on the tail-feathers of *Lamprotornis longicauda*, &c. Primary quills and tail light sepia-brown, the former being almost white on their under surface, when held in some directions of light. Tail-feathers much narrowed towards their tips, and their shafts particularly strong. Total length 17½ inches. (Sw.)

Habits, &c.—Mr. Swainson remarks, that from the circumstance of Le Vaillant having found this species to be migratory in South Africa (where it is seen either singly or in small flocks), there can be no doubt that it quits Senegal at certain seasons along with the Grakles, and returns to West Africa to breed. Mr. Swainson infers the latter circumstance from having seen a young specimen from Senegal, before it had quite gained its full wing-feathers. He also remarks that the sharpness and curvature of its claws shows that the bird, although possessed of an ambulating foot, is yet more accustomed to perch upon trees than to walk upon the ground. (*Birds of West Africa.*)

PTILO'TIS. [Meliphagidæ, vol. xv., p. 82.]

Subgeneric character.—*Bill* short. Lateral *toes* almost equal. *Tail* slightly rounded, sometimes nearly even. (Sw.)

PTILOTU'RUS. [Meliphagidæ, vol. xv., p. 82.]

I. PTOLEMÆUS (Πτολεμαῖος), surnamed **SOTER**, or 'preserver,' the founder of the dynasty of Greek kings in Egypt, frequently called the Lagidæ, was one of the ablest of the generals of Alexander the Great. He is commonly called the son of Lagus, but, according to the Macedonians, he was the son of Philip and grandson of Amyntas, but was called the son of Lagus, because his mother was given for wife to Lagus by Philip, though she was then with child. (Paus., i. 6, § 2.)

In the division of the provinces on the death of Alexander, B.C. 323, Egypt was assigned to Ptolemy, who soon took measures to erect it into an independent kingdom. He put to death Cleomenes, who had been appointed satrap of Egypt by Alexander, chiefly because he was well disposed to Perdiccas (Paus., i. 6, § 3), and obtained by his death an immense sum of money, which Cleomenes had collected during his administration. With this money, which amounted, according to Diodorus (xviii. 14), to 8000 talents, he collected a large army. In the first or second year of his rule he took the city of Cyrene and added the Cyrenaica to his dominions. He also obtained possession of the dead body of Alexander, which it had been resolved in the council at Babylon to transport to Ægæ in Macedonia. It was first carried to Memphis, and afterwards to Alexandria.

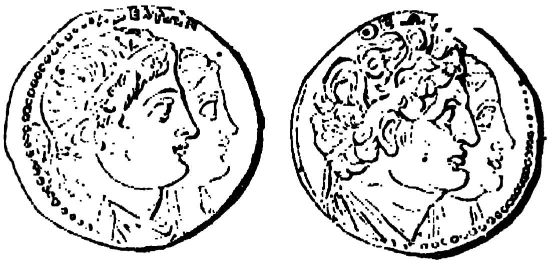
In the year B.C. 321 Perdiccas invaded Egypt; but he lost 2000 men in attempting to cross the Nile, and was subsequently murdered in his tent by his own troops. [Perdiccas.] A few years afterwards Ptolemy had to encounter a more formidable rival in Antigonus, who was rapidly increasing in power; and in B.C. 316 he entered into an alliance with Seleucus, Cassander, and Lysimachus, to resist the ambitious projects of Antigonus. In the long war which followed, and of which an account is given in the article Antigonus, Ptolemy took an active part. It was continued till B.C. 312, when a general treaty was made, by which Ptolemy obtained possession of Egypt and the adjacent districts. Ptolemy however was the first to break this treaty in the following year; and the war was again renewed, and carried on with various success, till the defeat and death of Antigonus, at the battle of Ipsus, B.C. 301, secured to Ptolemy the undisturbed possession of Egypt.

From this time to his death, Ptolemy devoted all his energies to develop the resources and promote the prosperity of his kingdom. Under his wise government and that of his successor, Alexandria became, as its great founder had anticipated, the first commercial city in the world, and the place from which Europe was supplied with the rich merchandise of the East. As his subjects consisted of two distinct nations, the Egyptians and Greeks, it was the policy of Ptolemy and his successors to amalgamate these races as much as possible. Ptolemy, being a Greek, introduced Greek habits and customs and also the Greek religion into Egypt; but, like his great master Alexander, he carefully avoided offending the prejudices of his new subjects, and adopted to a certain extent the Egyptian forms of worship. He and his successors conciliated the favour of their subjects, by the respect which they paid to the antient Egyptian priesthood, and also by contributing largely to the restoration of the antient monuments of the country. ('British Museum,' *Egyptian Antiquities*, vol. i., p. 35, Lond. 1832.) He also introduced the most complete religious toleration among all his subjects. The troubled state of Palestine and the growing commerce of Alexandria induced many Jews to settle in his dominions; and the same toleration was granted to the Jewish synagogue as to the temples of Isis and Jupiter. Ptolemy seems to have been desirous of uniting as much as possible the Egyptian and Greek religions; and his removal of the statue of Serapis from Pontus to Alexandria, which is mentioned by several antient writers (Tacit., *Hist.*, iv. 84, and commentators), and which was accompanied with great solemnity, seems to have been accomplished in order to establish the worship of a deity which might prove acceptable to both nations.

Ptolemy gave great encouragement to learning and science. He wrote himself a history of the wars of Alexander, which appears to have been a work of considerable merit, and which supplied Arrian, in conjunction with the narrative of Aristobulus, with the materials for his history. [Arrian, p. 395.] He invited many scholars and philosophers from Greece, of whom the most celebrated was Demetrius Phalereus [Demetrius], who was received by him with the greatest distinction. He also invited Theophrastus (Diog. Laert., ii. 37), and received Stilpo (Diog. Laert., ii. 115), who had been banished from Athens for his religious opinions. In fact, Ptolemy extended his patronage to all persons of learning, independent of their religious and philosophical opinions. He laid the foundations of that school of learning for which Alexandria became afterwards so celebrated; and he probably commenced making collections for the public library which was regularly established by his son.

Ptolemy Soter was first married to Eurydice, the daughter of Antipater, by whom he had children; but he left his dominions to a younger son, Ptolemy Philadelphus, whom he had by Berenice (Paus., i. 6, § 8; Justin, xvi. 2; Plin., *Hist. Nat.*, xxxvii. 32). [Berenice.] His eldest son, Ptolemy Ceraunus, murdered Seleucus, B.C. 280, and obtained possession of the kingdom of Macedonia. He only reigned however for about a year, and fell in battle with the Gauls. (Paus., i. 16, § 2; x. 19, § 4; Strabo, xiii., p. 623; Justin, xxiv. 5.)

Ptolemy Soter assumed the title of king, B.C. 306 (Diod., xx. 53; Plutarch, *Demetr.*, c. 18); and died at the age of 84 (Lucian, *Macrob.*, c. 12), B.C. 283, forty years after the death of Alexander. All the antient writers agree in representing Ptolemy as a prince of the greatest wisdom, prudence, and generosity; and there is a saying of his reported by Ælian (*Var. Hist.*, xiii. 12), worthy of Alexander, 'that it was better to make rich than to be rich.'



Coin of Pt[illegible]y and Berenice.
British Muse[illegible] Actual Size. Gold.

The two heads to the right are Ptolemy Soter and his wife Berenice. The two heads to the left are Ptolemy Philadelphus and his sister and wife Arsinoe. The words ΘΕΩΝ ΑΔΕΛΦΩΝ, 'the fraternal deities' occur in the Adule Inscription, and apply to Ptolemy Philadelphus and Arsinoe. [Adule.]

II. **PTOLEMÆUS**, surnamed **PHILADELPHUS**, or the 'brother-loving,' succeeded his father, B.C. 283, but was associated with him in the government two years previously. He followed the example of his father in the encouragement of learning; and he maintained with great liberality many distinguished philosophers and poets, of whom the most celebrated were Theocritus, Lycophron, and Callimachus. He established the public library, which was probably commenced by his father, and also founded a museum (*μουσεῖον*) for the promotion of learning and the support of learned men. Some modern writers attribute the foundation of this museum to Ptolemy Soter, but Athenæus (v., p. 203) distinctly ascribes it to Philadelphus. (Clinton, *Fasti Hell.*, iii., p. 380.) We learn from Strabo (xvii., p. 794) that the museum formed part of the palace, and that it contained cloisters or porticos (*περίπατον*), a public theatre or lecture-room (*ἐξέδρα*), and a large hall (*οἶκον μέγαν*), where the learned men who belonged to it dined together. The museum was supported by a common fund, supplied apparently from the public treasury; and the whole institution was under the superintendence of a priest, who was appointed by the king, and, after Egypt formed a province of the Roman empire, by the Cæsar. Attached to the museum there were botanical and zoological gardens. (Philostr., *Apollon.*, vi. 24; Athen., xiv., p. 654.) The institution was enlarged by the emperor Claudius. (Suet., *Claud.*, c. 42, with Casaubon's 'Note.')

Ptolemy Philadelphus showed the same favour to the Jews as his father had done; and it was under his auspices that the Hebrew Bible was translated into Greek. [Septuagint.] Josephus (*Antiq.*, xii., 2, § 12) has given us an account of the entertainment at which Ptolemy received the translators; and which is interesting, as it affords us some idea of the literary parties which the king appears to have frequently given. The king sat at the head of the table, and the guests on each side. The usual priests, heralds, &c. were sent away, and grace was said by one of the translators at the command of the king. This grace or prayer was received with loud applause by the whole company. After supper the king began to philosophise, and asked every one of his guests a philosophical question.

The treasures and resources of Philadelphus were very great. Much of the wealth which he possessed was, without doubt, owing to his possessing the trade with India and other parts of Eastern Asia. He also used every effort to extend the trade of Alexandria; he obtained possession of the maritime parts of Arabia and of the eastern coast of Africa, and his admiral Timosthenes appears to have gone as far south as Madagascar. (Vincent's *Commerce and Navigation of the Antients, &c.*, vol. i., p. 42.) Theocritus (*Adoniazusæ*) describes in glowing colours the wealth and power of his patron; and his account is confirmed by the less suspicious testimony of Appian, who was himself a native of Alexandria. The latter writer informs us (*Præfatio Histor.*, c. 10) that under the Ptolemies the army consisted of 200,000 foot soldiers, 40,000 horse, 300 elephants, and 2000 war-chariots, and the fleet of 2000 smaller vessels, 1500 triremes, and 800 ships magnificently adorned and equipped for royal use. The money in the treasury amounted to 740,000 Egyptian talents at the death of Ptolemy Philadelphus, who, according to Appian, amassed greater treasure and expended more upon public works than any of his successors. Athenæus also bears testimony (ii., p. 203) to the great power of Philadelphus, and states among other things that he surpassed all other kings in the number of his ships. The power and influence of the Egyptian kingdom under the three first Ptolemies is also attested by Polybius (v. 34), who says that they were masters of Cœle-Syria and Cyprus, and extended their influence over the neighbouring countries as far as Thrace and Macedonia. (Clinton's *Fast. Hellen.*, iii., p. 383.)

The political events of the reign of Ptolemy Philadelphus may be comprised in a few words. He put to death, at the commencement of his reign, two of his brothers, one of whom had endeavoured to excite the Cyprians to revolt. He was also engaged in war with Magas, the son of Berenice by a former husband, who had been appointed governor of Cyrene. Magas, who was married to Apama, the daughter of Antiochus and grand-daughter of Seleucus, prevailed upon his father-in-law to break the treaty which had been made between Seleucus and Ptolemy. Ptolemy however, by assuming the defensive, prevented Antiochus from invading his dominions (Paus., i. 7, § 3), and finally concluded a peace with his successor Antiochus II., by which the latter agreed to repudiate his wife Laodice, and to marry Berenice, the daughter of Ptolemy. [Antiochus II.]

In B.C. 274 Ptolemy sent an embassy to Rome and formed an alliance with the republic. (Liv., *Epit.*, 14; Eutrop., ii. 15.) We also read of a Roman embassy to Egypt. (Justin, xvii. 2.) Ptolemy sent a naval force to the assistance of the Athenians against Antigonus and the Macedonians (Paus., 1, 7, § 3); and the Athenians in compliment to him called one of their tribes Ptolemais. (Paus., i. 6, § 8: i. 5, § 5.) Ptolemy also founded a gymnasium at Athens, not far from the market-place, which was called after his name, and which contained a bronze statue of him. (Paus., i. 17, § 2.) [Athens, p. 11.]

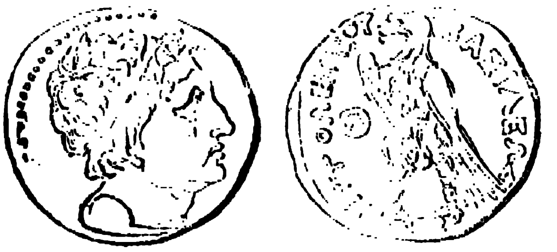
Ptolemy Philadelphus died, B.C. 247, after reigning two years with his father and thirty-six alone. He was married twice; to Arsinoe, the daughter of Lysimachus, and also to Arsinoe, his own sister. [Arsinoe.] Pausanias remarks (i. 7, § 1) upon his marriage with the latter, that in doing so he violated the laws of the Macedonians, but not of the Egyptians. By his sister he had no children, but by the daughter of Lysimachus he had three, Berenice, Ptolemy surnamed Euergetes, and Lysimachus. (Schol. Theocr., xvii. 128, quoted by Clinton.)

III. **PTOLEMÆUS**, surnamed **EUE'RGETES**, or the 'benefactor,' succeeded his father B.C. 247. He was engaged in war at the commencement of his reign with Seleucus Callinicus, to revenge the death of his sister Berenice. [Berenice II.] Great success attended his arms: he obtained possession of many of the provinces belonging to the Seleucidæ, and would probably have overthrown their empire, if he had not been obliged to return to Egypt in consequence of some civil commotions. (Justin, xxvii. 1.) Seleucus tried to strengthen his power by entering into an alliance with his brother Antigonus Gonatas; but they quickly became jealous of each other, and Ptolemy availed himself of their dissensions to extend his kingdom.

We possess hardly any particulars respecting the life and character of Ptolemy Euergetes. If inferior to his predecessors, he was superior to these that reigned after him; Strabo says (p. 796) that the kings of Egypt after the third Ptolemy governed worse than their predecessors. He followed his father's example in giving every encouragement to trade and commerce. It appears from an inscription, which was found at Adule by Cosmas [Adule], that Ptolemy had conquered Abyssinia, and that he maintained a powerful fleet in the Red Sea. A translation of this inscription, with many valuable remarks, is given in Dr. Vincent's 'Commerce and Navigation of the Antients in the Indian Ocean,' vol ii., p. 533, &c. If we can trust to this inscription, Ptolemy Euergetes must in his wars with Seleucus have subdued the greater part of Asia. It states that he had received from his father the kingdom of Egypt, Africa, Syria, Phœnicia, Cyprus, Lycia, Caria, and the Cyclades, and that he invaded Asia with his land and sea forces, and with elephants from the country of the Troglodytes and Ethiopians. The inscription then states that with these forces he reduced all the country on this side the Euphrates, as well as Cilicia, the Hellespont, Thrace, and all the forces in these provinces; and that he afterwards crossed the Euphrates, and entered Mesopotamia, Babylonia, Susiana, Persis, Media, and the whole country as far as Bactria, and brought the whole under his dominion.

During the reign of Euergetes, Cleomenes, king of Sparta, took refuge in Egypt, and was received by him with great distinction. (Plutarch, *Cleom.*, c. 32; Paus., ii. 9, § 3; Justin, xxviii. 4.)

Ptolemy Euergetes married Berenice, the daughter of Magas, king of Cyrene. [BERENICE III.] By her he had three children, Magas, Ptolemy Philopator, and Arsinoe. He was murdered by his own son Philopator, B.C. 222.



Coin of Ptolemæus Euergetes.
British Museum. Actual Size. Silver.

IV. PTOLEMÆUS, surnamed **PHILO'PATOR**, or 'father-loving,' succeeded Euergetes, B.C. 222. He was distinguished by his profligacy and cruelty, and is said to have been ironically called Philopator on account of having murdered his father. (Justin, xxix. 1.) His chief minister was Sosibius, at whose instigation he put to death his mother Berenice, his uncle Lysimachus, his brother Magas, his wife and sister Arsinoe, who is called Eurydice by Justin (xxx. 1), and Cleomenes the Spartan king. (Polyb., v. 34, 35; xv. 25; Plutarch, *Cleom.*, 33, 34, &c.) Philopator however appears to have been an able general. In B.C. 219 the province of Cœle-Syria, which had been conquered by his father, was attacked by Antiochus the Great, who at first obtained possession of the greater part of it through the treachery of Theodotus, the Egyptian governor. In the following year however the forces of Ptolemy were more successful. Antiochus was defeated in a great battle fought at Raphia, near Gaza, B.C. 217; and Cœle-Syria and Palestine were ceded to Ptolemy by a treaty made in the same year. (Polyb., iv. 37; v. 79-87.) [ANTIOCHUS III.]

Philopator died B.C. 205, after a reign of seventeen years. (Clinton.)

Coin of Ptolemæus Philopater.
British Museum. Actual Size. Silver.

V. PTOLEMÆUS, surnamed **EPI'PHANES**, or 'illustrious,' the son of P. Philopator and Arsinoe, was only five years old at the death of his father. (Justin, xxx. 2.) Antiochus the Great thought it a favourable opportunity not only to recover Cœle-Syria, but also to obtain the sovereignty of Egypt, and accordingly united with Philip, king of Macedon, to divide the Egyptian dominions between them. (Polyb., iii. 2; Liv., xxxi. 14.) The guardians of the young king took the precaution of placing him under the protection of the Romans, which the latter willingly undertook, as they were anxious to obtain a pretext for attacking Philip and Antiochus. (Justin, xxx. 2, 3.) Livy also mentions (xxxi. 9) an Egyptian embassy to Rome in B.C. 200.

When the Romans were engaged in their war with Philip, Antiochus attacked the dominions of Ptolemy, and reduced, in B.C. 198, all the cities in Cœle-Syria. He also conquered Scopas, who had in the preceding year brought 6000 auxiliaries to Ptolemy. (Liv., xxxiii. 19.) But as Antiochus was anxious to prosecute his conquest in Asia Minor, he proposed a treaty of marriage between his daughter and Ptolemy, to be consummated when both came of age, by which Cœle-Syria and Palestine were to be given with the princess as a dowry. (Polyb., xxviii. 17; Joseph., *Ant.*, xii. 4, § 1.) This marriage was afterwards celebrated in the year B.C. 192 or 193, when Ptolemy was about seventeen years of age.

Ptolemy died B.C. 181, and is said to have been poisoned. (Hieron., *Ad Dan.*, c. 11.) He left three children, P. Philometor, P. Physcon, and Cleopatra, who was successively married to her two brothers. (Joseph., *Antiq.*, xii. 4, § 11; Justin, xxxviii. 8.)

Coin of Ptolemæus Epiphanes.
British Museum. Actual Size. Gold.

VI. PTOLEMÆUS, surnamed **PHILOMETOR**, or 'mother-loving,' was a child when his father died; but the government was conducted by his mother Cleopatra. During the life-time of Cleopatra, the kingdom of Egypt enjoyed repose; but on her death, her brother Antiochus Epiphanes claimed Cœle-Syria and Palestine, which had been given to Ptolemy Epiphanes as his wife's dower. In B.C. 171 Antiochus invaded Egypt and defeated the army of Philometor at Pelusium; and in the following year he took most of the principal towns in Egypt, with the exception of Alexandria, and obtained possession of the person of Philometor. After the capture of Philometor, the Alexandrines raised his brother to the throne, who took the name of Euergetes II., but is more commonly known by that of Physcon.

In B.C. 169 Antiochus invaded Egypt for the third time, under pretence of restoring the kingdom to Philometor. He laid siege to Alexandria, and would probably have obtained possession of the city, had not ambassadors come from Rome, who commanded him to abandon the attempt. Afraid of provoking a war with the Romans, he retired from Egypt, leaving Philometor nominal king of the whole country with the exception of Alexandria. He appears to have hoped that the quarrels of the brothers would have still further weakened the country and rendered it an easier conquest to him; but they, seeing through his ambitious designs, agreed to divide the royal power between them, and turn their forces against him. Disappointed in his object, Antiochus again invaded Egypt in the following year (B.C. 168), and declared that he would not withdraw his forces unless Cyprus, and the strong city of Pelusium, with the surrounding country, were ceded to him. As the possession of the city of Pelusium would have enabled him at any time to overrun Egypt, his proposals were refused; and he accordingly marched towards Alexandria, but was again met within four miles of the city by the Roman ambassadors, who compelled him to depart from Egypt. (Liv., xlv. 11, 12.)

The two brothers however did not agree; and in the seventh year of their joint reign Philometor was driven from Egypt by Physcon, and obliged to take refuge in Rome. He was treated with great distinction by the senate, who restored him to his kingdom, and limited the dominions of Physcon to Cyrene. (Liv., *Epit.*, 46, 47; Valerius Max., v. 1, § 1.) In the following year Physcon went to Rome to complain of the unequal division of the Egyptian kingdom, and to beg that Cyprus might be given to him. The senate complied with his request, and commanded Philometor to surrender that island to his brother Philometor however refused to do so; and the Romans accordingly declared war against him, B.C. 159 (Diod. Sic., vol. ii., p. 626, ed. Wesseling), but did not prosecute it with much activity. They did not send any force to the assistance of Physcon, but gave permission to their allies in Greece and Asia to enlist under his standard. (Polyb., xxxiii. 5.) In the war which followed between the brothers, the Romans took no part. Physcon was defeated in Cyprus, and fell into the hands of Philometor, who however forgave him, and allowed him to retain the sovereignty of Cyrene. (Polyb., xl. 12; Diod. Sic., vol. ii., p. 588.)

About the year B.C. 151, Ptolemy Philometor marched into Syria to support Alexander Balas (Justin, xxxv. 1), who had been acknowledged king of Syria by the Romans, in opposition to Demetrius, the rightful heir. [ALEXANDER BALAS.] By the assistance of Philometor and the kings of Pergamus and Cappadocia, Alexander obtained possession of the throne, and married, in B.C. 150, Cleopatra, the daughter of Philometor. (1 *Macc.*, x. 57, 58; Joseph., *Antiq.*, xiii. 4, § 1.) Shortly afterwards however Philometor, accusing Alexander of an intention to murder him, took away his daughter, and gave her in marriage to Demetrius II. He then marched into Syria, and was crowned at Antioch as king of Asia and Egypt; but afraid of exciting the jealousy of the Romans, he relinquished Syria to his new son-in-law. During these transactions Alexander was in Cilicia; and as soon as he heard of what had taken place, he marched towards Antioch, near which he was defeated by Ptolemy and Demetrius. Philometor however died a few days afterwards of the wounds which he had received in battle. (1 *Macc.*, xi. 1-18; Joseph., *Antiq.*, xiii. 4, § 6-8; Justin, xxxix. 2.)

The character of Ptolemy Philometor is favourably drawn both by Polybius (xxix. 9, § 13; xl. 12) and Diodorus (vol. ii., p. 588). He was an active and enterprising prince, and did much during the latter years of his reign to repair the losses which his subjects had sustained by the conquests of Antiochus Epiphanes, and in the wars between himself and his brother. He was mild and merciful, and his conduct in that respect was a striking contrast to that of his father and brother. He died B.C. 146, after a reign of thirty-five years. (Clinton.) He left a son, who was only a child at his death, and two daughters of the name of Cleopatra, of whom one married successively Alexander Balas and Demetrius, as already stated, and the other afterwards reigned in Egypt jointly with her sons.

VII. PTOLEMÆUS, surnamed **EUERGETES II.**, or **PHYSCON** (big-belly), succeeded his brother B.C. 146, and commenced his reign by putting to death his brother's son. (Justin, xxxviii. 8.) Physcon is represented by the antient writers as a cruel and sensual tyrant. He derived his name of Physcon, or Big-Belly, from his unwieldy form; for he was, according to Justin (xxxviii. 8) and Diodorus (vol. ii., p. 597), ugly in face, short in stature, big-bellied, and more like a beast than a man. The portrait which Rosellini gives of Physcon, from the antient monuments of Egypt, is also that of a fat and sensual man. ('British Museum,' *Egyptian Antiquities*, vol. ii., p. 88, 89.) Posidonius the Stoic also described him (Athen., xii., p. 549) as a fat unwieldy man, who never went out without a stick.

He married Cleopatra, his own sister and his brother's widow, who bore him a son in the second year of his reign, while he was at Memphis for the purpose of being crowned. (Diod., vol. ii., p. 595.) He soon afterwards put away his sister, and married her younger daughter, his own niece, Cleopatra. He practised all kinds of cruelties upon his subjects, till at length Alexandria became almost deserted, and Physcon was obliged to solicit strangers to settle there. (Justin, xxxviii. 8.) He possessed an able minister in Hierax (Diod., vol. ii., p. 597), who compensated in some degree for the inactivity of the king, and restrained for a time the discontents of his subjects; but at length the people could bear his cruelty no longer, and in the sixteenth year of his reign compelled him to fly to Cyprus. The government was committed by the people to Cleopatra, his sister and divorced wife. Her son was with his father at Cyprus; and Physcon, fearing lest she might make use of her son's name to strengthen her on the throne, put him to death, and sent his hands, feet, and head to Cleopatra, with directions that they should be given her in the midst of an entertainment. (Diod., vol. ii., p. 602, 603; Justin, xxxviii. 8; Liv., *Epit.*, 59; Valer. Max., ix. 2, § 5.) In the war which followed, Physcon again obtained possession of the throne, which he held till his death, B.C. 117.

In the year B.C. 143, Scipio Africanus was sent at the head of a Roman embassy to Egypt, and was received with great pomp and respect by Physcon, who conducted him as far as Memphis. (Diod. Sic., vol. ii., p. 629, 630; Justin, xxxviii. 8.)

Physcon, though a sensualist and a tyrant, was a patron of learning and the fine arts. He was a disciple of Aristarchus, and wrote himself an historical work, which is frequently referred to by Athenæus (ii., p. 71; xiv., p. 654, &c.). Physcon had by his niece Cleopatra five children; two sons, Ptolemy Soter and Alexander, and three daughters, Tryphæna, Cleopatra, and Selene. He also left an illegitimate son, Ptolemy Apion, who reigned at Cyrene, and bequeathed his kingdom to the Romans at his death in B.C. 96. (Clinton, vol. iii., p. 389.)

VIII. PTOLEMÆUS, surnamed **SOTER II.**, but more frequently called **LATHY'RUS** (Λάθουρος, Strab., p. 795), succeeded his father Euergetes II., B.C. 117. He reigned together with his mother Cleopatra, who wished to have her younger son Alexander for her partner on the throne, but she was obliged by the people to select the elder. (Justin, xxix. 3.) She always showed the greatest hostility to her eldest son, who is sometimes in consequence called ironically Philometor. (Paus., i., ix. § 1.) During the lifetime of Physcon, Lathyrus was sent to Cyprus; and though compelled to make him king, she did everything in her power to weaken his authority. At the commencement of his reign she compelled him to put away his sister Cleopatra, to whom he was married, and marry his youngest sister Selene. (Justin, xxxix. 3.) She gave the island of Cyprus to her younger son, and after reigning ten years in conjunction with Lathyrus, at length raised an insurrection in Alexandria against him, which compelled him to leave Egypt. She permitted him however to retire to Cyprus, after taking away from him his wife Selene; and she recalled her younger son Alexander to Egypt, and associated him with her in the government, B.C. 107. (Justin, xxxix. 4; Paus., i. 9, § 2.)

Lathyrus subsequently took an active part in the affairs of Palestine. Gaza and some other cities of Palestine requested his assistance against Alexander Jannæus, and he accordingly landed in Palestine with an army of 30,000 men. (Joseph., *Antiq.*, xiii. 12.) He at first met with considerable success, but Cleopatra, fearing lest her son, after the conquest of Palestine, should march upon Egypt, sent an army to the assistance of Alexander, which compelled Lathyrus to give up the war and retire to Cyprus.

In the year B.C. 89, Cleopatra was put to death, after a reign of 28 years, by her favourite son Alexander, who wished to obtain the sole possession of the crown. The people however rose against him a few months after, and compelled him to flee from Egypt. His brother Lathyrus was then restored. (Paus., i. 9, § 2, 3; Justin, xxxix. 5.) The city of Thebes however refused to submit to his authority; but it was taken and plundered after a siege of three years. (Paus., i. 9, § 3.) He died B.C. 81, leaving a daughter, Berenice or Cleopatra, and two illegitimate sons, Ptolemy Auletes and Ptolemy who reigned in Cyprus. The latter is mentioned in several of Cicero's orations (*Pro Sextio*, 26; *Pro Domo*, 8, 20; *Pro Flacco*, 13).

There is some difficulty respecting the immediate successor of Lathyrus. It appears that there were two kings of the name of Alexander, who successively reigned between the death of Lathyrus and the accession of Auletes; but as Clemens of Alexandria (*Strom.*, i., p. 331) and Strabo (xvii., p. 796) both mention Auletes as the immediate successor of Lathyrus, the authority of the two Alexanders was probably not acknowledged in all parts of Egypt, or they must at least have reigned for a very short time. The subject is fully discussed by Mr. Clinton (vol. iii., p. 391, 392).

IX. PTOLEMÆUS, surnamed **NEOS DIONY'SUS**, 'the young Dionysus,' but more commonly **AULE'TES**, 'the piper,' was an illegitimate son of Lathyrus, and succeeded to the throne B.C. 81. His vices and low habits made him contemptible to his people (Strabo, xvii., p. 796; compare Cic., *De Leg. Agrar.*, ii. 16), who expelled him from Alexandria in B.C. 58. He came to Rome in the same year, and on his way thither met Cato at Rhodes. (Plut., *Cat. Min.*, c. 35.) The Alexandrians placed upon the throne Berenice, the daughter of Auletes, and sent ambassadors to Rome to plead their cause against the king. Auletes however found means to gain over a large party in the senate. Cicero made a speech in his favour, which was afterwards published, but of which only a few fragments have come down to us; and the creditors of Auletes, who were very numerous, used every exertion to obtain his restoration to his kingdom. In the following year, B.C. 57 the senate passed a decree for his restoration; but in B.C. 56 there was much dispute respecting the manner in which and the persons by whom he should be restored. In consequence of the opposition which was made against him, nothing was done in that year; and we find that he retired in despair to Ephesus. (Dio., xxxix. 12-16; Cic., *Ep. ad Qu. Fr.*, ii. 2; *Ad Fam.*, i. 1, 2.) Auletes however possessed a powerful friend in Pompey, and in consequence of his support he prevailed upon Gabinius, in B.C. 55, to undertake his restoration. (Dio., xxxix. 55; Strabo, xvii., p. 796; Liv., *Epit.*, 105; Cic., *in Pison.*, 21.)

Berenice, whom the Alexandrians placed upon the throne, first married Seleucus, called Cybiosactes by Strabo, the pretended son of Antiochus Eusebes, and afterwards Archelaus, the son of the Archelaus who had carried on war against Sulla. Auletes, on his restoration in B.C. 55, put to death both Archelaus and his daughter. (Strabo, xvii., p. 796.) Anletes survived his restoration about three years and a half, and died in the beginning of May, B.C. 51. (Clinton, vol. iii., p. 395.) He left two sons, called Ptolemy, and two daughters, Cleopatra and Arsinoe. The history of his two sons is given under CLEOPATRA.

PTOLEMÆUS, CLAU'DIUS, a native of Egypt, but the place of his birth is not ascertained: the surname of Pelusiota, which is given to him in some editions of his works, appears to be a mistake of the copyists or translators. He lived at Alexandria in the first half of the second century of our æra, under the reigns of Hadrian and Antoninus Pius. Nothing more is known of his life, except his works. He was an astronomer, chronologist, and geographer. Ptolemy's Geography was for many centuries the text-book in that science for all the schools, and was superseded only in the fifteenth century, in consequence of new information derived from the discoveries of the Venetian, Portuguese, and other travellers and navigators.

Ptolemy and Strabo followed a different method in their respective works. Strabo's work is a descriptive geography; Ptolemy's is a mathematical geography. Strabo wrote mainly for the instruction of persons engaged in administration: he describes the physical character of each country, its extent, and its political divisions; he gives some historical account of the various peoples that had inhabited it; and he then proceeds to notice the subdivisions, the mountains, valleys, rivers, and towns, with their respective distances from each other, and the objects worthy of remark in them. He makes us acquainted with each place in a manner resembling that of modern books of travels, or guide-books. Ptolemy on the other hand applies himself to fix the astronomical position of each place; he gives a bare list of names of mountains, rivers, and towns, with their respective longitude and latitude, without any description, or at least only a few words. Strabo endeavours to ascertain the forms of the large masses of land and of the seas by a combination of itinerary distances between various points, referring only to a few positions which had been ascertained by actual observation: Ptolemy fixes the position of each place as if it were ascertained by astronomical observation. Ptolemy availed himself of the labours of Eratosthenes, Hipparchus, and the other mathematicians of the Alexandrian school [HIPPARCHUS]; but by adopting the method of Hipparchus in the projection of the map, in order to assimilate it to the spheroidal form of the earth, he committed a material error in his longitudes, all of which he places too far to the east. Beginning from Calpe, he places it 5° east of the Sacrum Promontorium of Iberia or Spain, an error of 1° 50′, and goes on increasing the excess of longitude as he advances to the eastward, making the length of the Mediterranean twenty degrees more than it is. He proceeds through Asia in the same way, till he places the mouths of the Ganges above forty-six degrees more to the eastward than the true position. Gosselin, at the end of his '*Géographie des Grecs analysée*,' gives tables which show the difference between Ptolemy's positions and the true ones. Gosselin supposes that Ptolemy was led into this material error by estimating the degree of longitude at stadia at the equator, and at 400 stadia in the parallel of Rhodes; while Eratosthenes had reckoned the first at 700 stadia, and the second at 555. But Ptolemy retained Eratosthenes's measure of 700 stadia for a degree of latitude, because he found that if he were to reckon the degree of latitude at 500, all his latitudes, several of which had been fixed by observation, would be too high; and that Alexandria, for instance, instead of being in 31°, would be in 43°, and Marseille in 60°. The different value given to the stadium by different geographers was a cause of much confusion. 'Eratosthenes,' says Gosselin, 'had fixed the distance between the Sacrum Promontorium of Spain and the eastern mouth of the Ganges at 70,000 stadia. These 70,000 stadia being reduced into degrees of 700 stadia each, give 100 degrees for the whole longitudinal distance, which is not far from the truth. But Ptolemy, by taking his degree of longitude too small, made 146 degrees between the two points. But again, if we reduce these 146 degrees at the rate of 500 stadia each, we shall have about 73,000 stadia.' See also on this subject both Mannert and Ukert, in their respective works, both entitled 'Geographie der Griechen und Römer.' '

Dr. Brehmer, in his 'Entdeckungen im Alterthum,' 1822, pretends that Ptolemy consulted some Phœnician charts, and he lays great stress upon the geographical knowledge of the antient Phœnicians. Gosselin however, as well as Heeren (*Commentatio de Fontibus Geographicorum Ptolemæi, Tabularumque iis annexarum*, Göttingen, 1827), reject Brehmer's hypothesis: they reduce within very moderate dimensions the supposed geographical and astronomical knowledge of the Phœnicians, and trace the sources of Ptolemy's peculiar information to other quarters, and especially to the discoveries and conquests made by Roman commanders between the time of Augustus and the age of the Antonines, to the long peace which subsisted between the Romans and the Parthians under Hadrian and Antoninus Pius, and the flourishing commerce which was carried on during that period between the Roman empire and the remotest parts of India. Marinus of Tyre, who lived about the year 100 of our æra, had written a geography and constructed maps of which Ptolemy availed himself.

Ptolemy begins by stating in his first book the object of his work, and explains the elements of mathematical geography. He then, after mentioning with praise his predecessor Marinus of Tyre, notices, in chapters vi. to xviii., the errors into which that geographer had fallen, and corrects them. Marinus had read the geographical works and itineraries of most of those who had preceded him, and had constructed maps which he repeatedly corrected in successive editions; but Ptolemy, as he says, still found much to correct in the work of Marinus. Ptolemy mentions several travellers from whose itineraries Marinus had derived much of his information, such as a certain Diogenes who navigated the Indian seas; Dioscorus and Theophilus, who frequented the harbour of Azania, on the eastern coast of Africa; Alexander, a Macedonian, who had sailed from the Chersonesus Aurea to Cattigara; Philemon, who had visited Hibernia; and a certain Titianus, called Maës, whose agents used to trade as far as Serica, the modern Tibet or Chinese Tartary; but he adds (chap. 17) that some of the information collected by Marinus had been superseded by the testimony of more recent travellers and navigators, whom he, Ptolemy, had consulted, especially with regard to the remote regions of India. In the last three chapters of the first book, Ptolemy describes the method of drawing maps adapted to represent the spherical form of the globe.

With book ii. begins the description of the known world, which in the time of Ptolemy extended, from west to east, from the Fortunate or Canary Islands, where Ptolemy places his first meridian, to the vaguely defined regions of Serica and Sinæ, near the western and south-western borders of China, somewhere between 100° and 105° east of London, embracing altogether about 120 degrees of longitude, or one-third of the actual circumference of the globe, which extent however, through Ptolemy's error already noticed, was magnified by him to 180 degrees, or a full hemisphere. To the northward Ptolemy's known world extended to the sixty-third parallel of north latitude, in which he places the island of Thule north of Caledonia, near the site of the Shetland Islands. Some think that the Thule of Ptolemy was Norway. To the south, Ptolemy's known world extends nearly to the equator, but he places his latitudes about ten degrees too far south. He places the sources of the true Nile, or Abiad, in about 7° S. lat., and the emporium of Rhapta, on the eastern coast of Africa, and that of Cattigara, on the coast of the Sinæ, in about 8°. By comparing Ptolemy's world with that of Strabo, it may be seen how much the limits of the known world were extended during the century and a quarter which elapsed from the time of Augustus and Tiberius to that of the Antonines. Strabo's information did not extend northwards beyond the Elbe; of Britain he knew little, and of Hibernia nothing; to the eastward it only extended as far as Taprobana (Ceylon) and the mouth of the Ganges. Ptolemy added information, though it was vague, of India beyond the Ganges, the Chersonesus Aurea, and the countries of Serica and Sinæ east of the Chersonesus Aurea. Strabo had made the Hyrcanian or Caspian Sea a gulf of the Northern Ocean, though Herodotus (i., c. 203) had described it as a lake. Ptolemy also describes it as a lake, retaining however the error of his predecessor as to making its length from east to west, instead of from north to south. This mistake originated probably in some confused notion of the existence of the Aral Lake east of the Caspian. In one respect however Ptolemy's information was more remote from truth than that of Strabo, for he made the Indian Sea a gulf, without any communication with the Atlantic, and he supposed that the south-eastern coast of Africa turned to the east and joined that of Asia. This authority perpetuated for a long time the error of supposing that Africa could not be circumnavigated by the south. This error is the more curious, as there was an old tradition, preserved by Herodotus, of the circumnavigation of Africa. [Africa.] With regard to the interior of Africa, Ptolemy's information extended considerably further than that of his predecessors. [Niger.]

Ptolemy proceeds in his description of the world from west to east. He begins with Hibernia, and Albion or Britain, stating the bearing of the great lines of coast, noticing the gulfs, æstuaries of rivers and capes, with the longitude and latitude of each, and he mentions the names of the various tribes and towns in succession, first those along the coasts, and afterwards those in the interior. His latitudes in Britain and Ireland are all too high by several degrees. He next describes Iberia, or Spain, with its divisions into provinces, stating the boundaries of each, and then, following the coast, he names the various towns, rivers, gulfs, and capes, fixing their respective positions. Few other particulars are given. We subjoin a specimen of the manner of his description:—'Iberia contains three provinces, Bætica, Lusitania, and Tarraconensis. The side of Bætica which looks to the west and north, is bounded partly by Lusitania and partly by the Tarraconensis province, and the description of this part is as follows:—

	Long.	Lat.
'The eastern mouth of the river Anas in .	4⅓	37½
Bend of the river to the eastward . .	6⅓	39
The part of the river nearest to Lusitania .	9	39
And the boundary line between Bætica and Tarraconensis reaches the coast of the Balearic Sea in . . .	12	37¼
The sources of the Anas are in . .	14	40

'The southern boundary of Bætica is formed by the external ocean and the Straits of Hercules, and to the eastward by the Iberian Sea, and the description of this part is as follows, beginning from the æstuary of the Anas, in the external ocean:—

Country of the Turdetani.	Long.	Lat.
Onobalisturia	4⅔	37⅓
Mouth of the Bætis . . .	5	37
Sources of the river . . .	12	38⅛
Æstuary near Astan . . .	6	36½¼
Country of the Turduli.		
Menesthei portus . . .	6	36⅓
Promontory at the entrance of the straits, on which is the temple of Juno . .	5½¼	$36\frac{1}{12}$
Mouth of the river Bælon . .	6⅙	36⅛
Bælon town	6¼	36⅔
Bastuli called Pini.		
Menralia	6½	36½
Transdumenorum . . .	6⅔	36¼
Barbesola	7¼	36⅙
Carteia	7½	36⅙
Mount Calpe and pillar . . .	7½	36⅛

Ptolemy goes on describing after this manner the whole f Spain, and afterwards Celto-Galatia, or Gaul, and then ermany. Ptolemy notices the Chersonesus Cimbrica and e southern part of the Baltic as far eastward as the river hesinus, the modern Duna. But Ptolemy does not seem have known that the Baltic was an inland sea. East of e Chersonesus Cimbrica he places four islands, under the ame of Scandiæ Islands. Scandinavia in his time was pposed to be an island. After Germany he describes hætia, Vindelicia, Noricum, Pannonia Upper and Lower, d Illyria, or Liburnia.

Book iii. contains a description of the eastern part of Europe, including Italy, with Sicily, Cyrnus or Corsica, Sardinia, European Sarmatia, Chersonesus Taurica, the country of the Iazyges Metanastæ, Dacia, Mæsia Upper and Lower, Thracia, with the Chersonesus, Macedonia, Epirus, Achaia, the Peloponnesus, Eubœa, and Creta.

Book iv. contains the description of Libya (Africa), namely, the two Mauritaniæ, Numidia, Africa Proper, Cyrenaica, Marmarica, Egypt, Libya, Æthiopia south of Egypt, the island of Meroe, and Interior Æthiopia. Book v. relates to Western or Lesser Asia, with the Greater Armenia, Colchis, Iberia, Albania, Arabia (Petræa and Deserta), Syria and Palestine, Mesopotamia, Babylonia, and the island of Cyprus. Book vi. treats of Asia Major, including Assyria, Susiana, Media, Persis, Parthia, Hyrcania, Carmania, Arabia Felix, Margiana, Bactriana, Sogdiana, Aria, Paropamisus, Drangiana, Arachosia, Gedrosia, the country of the Sacæ, Scythia within and without Mount Imaus, and Serica, the metropolis of which is placed by Ptolemy in $38\frac{1}{2}\frac{1}{12}$° N. lat., and 177½° E. long., but which seems to have been somewhere near the actual western borders of China, or the eastern part of Tibet.

Book vii. contains India within the Ganges, Taprobana, India without the Ganges, with the Chersonesus Aurea, and farther still the country of the Sinæ, which Ptolemy describes as bounded on the north by Serica and on the east and south by 'unknown lands,' and on the west partly by India beyond the Ganges, and partly by a great gulf of the sea, which separates it from the Chersonesus Aurea, which forms the southern extremity of India beyond the Ganges. This position seems to indicate the countries of Siam and Cambodia, and the great gulf as the Gulf of Siam. Ptolemy then mentions another gulf farther to the east as the Gulf of Sinæ, perhaps from a confused notion of the sea of Cochin-china and Tonkin. Cattigara, a mercantile station on the coast of Sinæ, which he places in 8½° S. lat., has been looked for by some on the coast of Borneo. Gosselin however thinks that the great gulf is the Gulf of Martaban, that Cattigara is Mergui, and Thinæ the capital of the Sinæ, Tenasserim, and that the Sinæ of Ptolemy is the country of Siam, and that Ptolemy's information did not extend so far as the eastern coast of the peninsula of Malacca. The length of that peninsula, and its apparent continuation by the coast of Sumatra, gave rise to the notion of a continuous land enclosing the Indian Ocean on the east and south, and joining this eastern coast of Africa. (See Ptolemy's ch. 14 of book i. on the 'Navigation from the Chersonesus Aurea to Cattigara.')

The enormous size given to Taprobana (Ceylon) by Ptolemy and other antient geographers probably originated in their mistaking the peninsula of India for an islan

A good view of Ptolemy's known world, reduced to its real extent and position, is given by Gosselin in a map at the end of the fourth volume of his 'Recherches sur la Géographie systématique et positive des Anciens, pour servir de Base à l'Histoire de la Géographie ancienne,' 4 vols. 4to., Paris, 1813. The map is inscribed, 'Orbis Veteribus noti veris Limitibus circumscripti Specimen Geographicum.'

The latter part of book vii. and book viii. are a recapitulation of his system, with a description of the maps, twenty-six in number, which accompanied the work, namely, ten for Europe, four for Africa, and twelve for Asia. [Agathodæmon.]

Several editions of Ptolemy's Geography, translated into Latin, appeared in the fifteenth century. Among the best are those of Rome, 1478 and 1490. The Greek text was first printed at Basle in 1535, under the care of Erasmus. Servetus published a Latin edition at Lyon in 1541. Petrus Bertius published the work in Greek and Latin, Amsterdam, 1619. The Abbé Halma published at Paris, 1828, the first book of Ptolemy in the Greek text with a French translation accompanied by a Memoir 'On the Measures of the Antients.' Sickler published in 1833, at Hesse Cassel, Ptolemy's description of Germany, from an old Greek MS. in the king's library at Paris, as a specimen of an intended correct edition of the whole work, which he proposed to publish by subscription: 'Claudii Ptolemæi Germania è Codice MSpto. Græco antiquissimo nondum collato, qui Lutetiæ Parisiorum in Bibliotheca Manuscriptorum Regia sub titulo Cod. Req. Fontablandensis, No. 1401, asservantur, accurate descripta; edidit Dr. F. C. L. Sickler of Hildburghausen.' There are in the royal library at Paris ten MSS. of Ptolemy. It is well known that all the old editions of Ptolemy, both Greek and Latin, are incorrect, and that numerous errors were introduced into the text by ignorant transcribers and translators, especially during the fourteenth century. It appears also that as new discoveries took place, people took upon themselves to interpolate and correct Ptolemy's text without much discrimination. (*Commentatio critico-litteraria de Claudii Ptolemæi Geographia, ejusque codicibus, tam manuscriptis quam typis expressis, conscripta*, à G. M. Raidelio, Norimbergæ, 1737.)

There is in the Imperial library at Vienna a fine MS. copy on parchment of Ptolemy's geography in Greek, with twenty-seven maps, which are stated at the end to have been constructed by Agathodæmon of Alexandria. „This statement is found also in another MS. in the library of St. Mark at Venice, as well as in others, and Raidelius read the same assertion in a fragment of an old MS. of the eleventh century. The maps which accompany the edition of Rome, 1478, and that of Ulm, 1482, appear to have been copied from the MS. maps. (Heeren, *De Fontibus*, &c.)

PTOLEMÆUS, son of Juba. [MAURITANIA.]

PTOLEMAIC SYSTEM. A few words of general explanation constitute all that can be given under this head, and we are not now speaking with particular reference to Ptolemy, of whose part in the matter we treat more particularly under SYNTAXIS, but of the astronomical part of that system which, founded on early metaphysical and physical doctrines adopted by Plato and Aristotle, reinforced by mathematical hypotheses drawn from Hipparchus and Ptolemy, received by the Mohammedans and by them imparted to the Christians of the middle ages, was the doctrine universally established in Europe till the seventeenth century. As a whole it combines the physics of the Aristotelian school, the geometry of Euclid and his successors, the sexagesimal arithmetic of the Greeks, and the astronomy of Hipparchus and Ptolemy, with some slight additions from later names. The geometry remains, the arithmetic has been supplanted by the decimal system of the Hindus; the physics and astronomy stood and fell together; and as under the words Ptolemaic System the astronomy is particularly meant, we only here notice the physical notions so far as they are connected with it.

The early separation of perceptible matter into the four elements of earth, water, air, and fire, with observation of the relative places they appear to assume, led to the formation of an elementary system. Earth (and solids generally) sink in water, while air rises in water, and flame in air. Hence the notion that the mass of the earth is the central body of the universe; above is a region of water, through which rises that portion of earth on which men and animals live. Above this is a region of air, and above this again a region of fire. Nothing is at rest until it arrives at its proper or natural place, and all the motions of a part separated from its whole are rectilinear; fire rises, and bodies fall, in straight lines. Gravity and levity are only the efforts of bodies separated from their natural places to return to them.

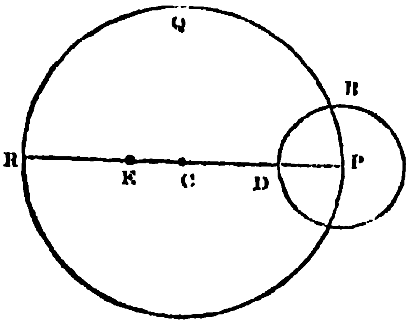
Above the earth and the elementary zones which encompass it, are other successive zones, called heavens. Each heaven contains an immense crystal spherical surface, to which one of the heavenly luminaries is attached, or would be attached, if it moved uniformly in a circle, as it would then do if the crystal sphere were made to revolve uniformly. But the varied motions of the heavenly bodies made it necessary that smaller orbs should be placed with their centres upon the larger ones, as hereafter noticed, and that the planets should move with the smaller ones. It is hardly to be believed (at least so many think) that Ptolemy and the mathematicians received these orbs, in the physical sense, or as anything but hypotheses for representing the actual motions of the planets; it is certain however that the actual solid orbs continued to be received till a late period; and even in the final scholium of the Principia, Newton thinks it worth while once more to overturn them, as Tycho Brahé had done before him, by showing that if they existed, the comets could not move as they were known to move.

The first heaven is that of the moon; the second that of Mercury; the third that of Venus; the fourth that of the Sun; the fifth that of Mars; the sixth that of Jupiter; the seventh that of Saturn; the eighth that of all the fixed stars. The heavens of Aristotle end here; later theorists add two more, a ninth, to make the precession of the equinoxes, and a tenth, or primum mobile, to make the diurnal revolution. All beyond this is the empyreal heaven.

The office of the *primum mobile* is to revolve from east to west in twenty-four hours, carrying with it (but how, we do not know) the whole of the subordinate heavens, and making all the phenomena of day and night. All the heavenly motions are to be circular and uniform; this doctrine of the Platonic school is the keystone of the whole system. The poles of the primum mobile are those of the equator; but the ninth heaven moves slowly round the poles of the ecliptic, carrying the whole system forward in longitude, so as to give the phénomena arising from the precession of the equinoxes. The heavens of the other heavenly bodies move round with the mean motions of the bodies depending upon them; and this completes the general view of the system

The details of the heavenly motions were for the mathematicians only, who dropped the orbs, and only took such circles out of them as were necessary in the explanation of the motions.

Without entering into all the details connected with this explanation, which are rather complicated, and require besides some knowledge of the actual inequalities of the planetary motions, we shall take the two leading circumstances of those motions, namely, their not being uniform, and their being sometimes direct, or according to the order of the signs of the zodiac, and sometimes retrograde. One way of explaining the simple irregularity of motion was by supposing the orb of the planet to be a sphere, and revolving uniformly, but not concentric with the earth. Let the earth be at E, and let the circle PQR revolve uniformly round the centre C, or let the planet P revolve uniformly in that circle. Consequently, the nearer the planet is to E, the faster it will appear to move, and the contrary, that is, a spectator at E will see the planet moving most slowly when at P, from whence the apparent motion will be accelerated until it arrives at R, and retarded while it returns to P on the other side. The circle PQR is called an eccentric. This hypothesis was a tolerably good representation of the motion of the sun, when EC was taken in a certain specified proportion to the radius CR; and if the sun had been placed at E, it would have made a sufficient representation of the motions of the planets, at least for the earlier periods of observation. But it must be remembered that though an acceleration and retardation would thus be established, it would not be precisely that of the planets, though sufficiently near, as remarked, to represent the results of rough observation.



The mode of obtaining the alternate progressive and retrograde motion is as follows:—Let P be the centre of a circle called an epicycle, and let P revolve uniformly round the earth at C, while the epicycle revolves uniformly round its centre, carrying the planet on its circumference, or while the planet revolves uniformly round the epicycle. Let the epicycle itself move in the direction PQR, and let the planet on the epicycle move in the same direction, or ABD. If then the times of revolution of the planet in the epicycle be sufficiently great compared with that of the epicycle itself, its retrogradation at D will more than compensate for the progression of the epicycle itself; that is, the planet will appear to a spectator at C to move in a retrograde direction, when it is in the lower part of the epicycle. But in the higher part, at A, both motions conspire to make it appear to move directly. There must consequently be an intermediate point at which the direct motion ceases and the retrograde begins; and near this point the planet will appear stationary.

It is by a complicated use of these methods that Ptolemy succeeds in giving a tolerable account of the angular motions known in his time; but they fail in placing the planet at the right distance from the earth, though they may place it nearly in the right longitude. We imagine that in modern times very few persons have taken the trouble to make themselves acquainted with the details of this system, These may be learnt, with some trouble, from Delambre's account of the Syntaxis (*Hist. Astron. Anc.*), but they are explained with much more clearness in Mr. Narrien's 'Origin and Progress of Astronomy,' London, 1833. Those who would have Ptolemy's own explanation at a less expense of time than is necessary to find it in the Syntaxis, should look at his short tract, *περὶ ὑποθέσεων τῶν πλανωμένων*, which was published with the Sphere of Proclus, by Dr. Bainbridge, in 1620. The physical views may be collected, as well as the mathematical ones, from the 'Philolaus,' the first work of Bouillaud, Amsterdam, 1639 [See also SYNTAXIS; TROCHOIDAL CURVES.]

PTOSIS is a dropping of the upper eyelid, which the patient cannot by any voluntary exertion raise from before the globe of the eye. In some cases this effect is produced by great inflammatory swelling of the eyelid with effusion of serum into its tissue; but in those cases to which the name of ptosis is more especially applied, it results from a paralysis of the third pair of nerves [BRAIN], or only of that branch of it which supplies the levator palpebræ muscle. [EYE.] These are in fact cases of local paralysis, and must be treated, without any particular reference to the eye, according to the principles on which paralytic affections in general are managed. [PARALYSIS.]

PTY'CHOGENS are those Endogenous plants whose leaves are occupied by veins running side by side from the base to the apex, without irregular division, as in grasses, lilies, &c. The name has been given in contradistinction to Dictyogens, which are those Endogens that, like Smilax, have the reticulated veins of Exogens. [SMILACEÆ.]

PTYCHOPLEURES, the name used by MM. Duméril and Bibron to designate a subfamily of the *Chalcidians* or *Cyclosaurs*, the seventh family of Saurians according to their arrangement. The other subfamily of the Chalcidians is named by them the *Glyptoderms*.

The *Ptychopleures* have the body covered with true scales, which are little or not at all imbricated, and distributed regularly in rings around the body, which is thus as it were circled. Most frequently there is a depression or furrow (sillon) throughout the length of the trunk, and which separates the sides of the abdominal region.

Only one genus is entirely without feet, and that (*Ophisaurus*) would be a true serpent if it had not eyelids, an auditory conduit, soldered jaws, and a tongue not sheathed. [OPHISAURUS.]

Pseudopus comes next, inasmuch as it has the rudiments only, or the indications, so to speak, of the existence of a pair of feet (posterior), with the longitudinal lateral furrow and the auditory aperture of the preceding genus. [SCHELTOPUSIK.]

All the other genera of the same group have two pairs of feet, or at least the rudiments of them, in which last case are the genera *Chalcides* and *Chamæsaura*. [CHALCIDES.]

The anterior appendages of the former corresponding to the anterior feet terminate by three or four scaly tubercles, whilst the posterior pair is often only represented by two slender stylets. Here there is neither trace of an auditory canal nor of femoral pores, and the lateral furrow is very little marked.

Chamæsaura has four appendages in lieu of feet, but they are not divided into toes at their extremity. The ear is apparent externally, and there are no folds along the lateral parts of the body.

Then come the species and consequently the genera which have the four feet terminated by toes well separated from each other. They may be divided into those which have only four toes and those which have five distinct toes.

Saurophis is the only genus with four toes only on the anterior and posterior feet. Their auditory canal or its tympanum is visible, as well as the longitudinal fold, and even the femoral pores. Among the genera with five toes on all the feet, and which thereby form an artificial division approximating to the true Lizards, there is one, *Heterodactylus*, which has been so named because the fifth toe of its anterior foot is so short that there was a belief that it did not exist: this genus moreover has neither tympanum nor abdominal furrow. The greater part have besides femoral pores, except the genus *Gerrhonotus*, whose tympanum is distinct and sunk in a canal, and in which the abdominal furrow is very apparent.

The other genera have femoral pores, but two are without that lateral fold which is found in the greater number of the species of this family. These are the genera *Ecpleopus* and *Pantodactylus*.

Among the other genera, there is one, *Gerrhosaurus*, the species of which have not strongly-spined scales round the tail, but they have all auditory apertures, a lateral furrow, and femoral pores. At first view they resemble the Scinks.

The two other genera have round their tails verticillations of rude solid scales, *Zonurus* or *Cordylus* and *Tribolonotus* which differ from each other by the papillæ with which their tongue is covered. They are in filaments and hairy in the first, whilst they are scales in the second, which besides wants the lateral folds, and has the back beset with strong spines, which seem to be adherent to the vertebræ.

The genera *Heterodactylus* and *Chalcides*, besides wanting the trace of external ears, have the eyelids very much attenuated. Their tongue, particularly that of *Chalcides*, very much resembles that of the *Amphisbænæ*, and they may be considered as almost insensibly leading the way to the *Glyptoderms*, to which we now draw the reader's attention.

MM. Duméril and Bibron characterise the *Glyptoderms* which correspond to the group of the *Amphisbænæ* by the quadrilled impressions observable all over their skin, which is besides annulated or marked with verticillations, with the trace of the lateral furrow (sillon). They allow the subfamily to contain only three principal genera, although they observe that authors have established a much greater number. They state that these genera are easily distinguished. first, because one only, *Chirotes*, is furnished with a pair of feet (anterior) the fingers of which are sufficiently distinct. In other respects it resembles the *Amphisbænæ*.

The other two genera have no feet, and have been generally arranged among the serpents. One of the most remarkable characters which distinguishes them however is the existence of the pores which are to be seen in front of the orifice of the cloaca in the *Amphisbænæ*, whilst there is not the slightest trace of it in the *Lepidosternon*, which has, as its name indicates, great scaly plates upon the lower and anterior part of the trunk near the neck.

The *Glyptoderms* are, further on in the work of MM. Duméril and Bibron, divided into *Acrodont Glyptoderms* and *Pleurodont Glyptoderms*.

The first section consists but of one genus, *Trogonophis*, Kaup.

The second comprises the genera *Chirotes* [CHIROTES], *Amphisbæna* [AMPHISBÆNA], and *Lepidosternon*. (*Erpétologie Générale.*)

PTYCHOTIS, a small genus of Umbelliferous plants, of which the seeds of some of the species have formed articles of condiment and of medicine from very early times. The genus extends from the south of Europe, through the Oriental region, to all parts of India. The calyx is 5-toothed. Petals obovate, bifid, or emarginate, with a long inflexed point. Fruit compressed laterally, ovate or oblong. Seed roundish, or flat before and convex posteriorly. The species are annual or biennial plants. Stem leaves usually cut into numerous capillary segments. Flowers white, disposed in compound umbels, of which the involucels are many-leaved, and the involucre either wanting or few-leaved.

The European species are not remarkable for any useful properties, but *P. coptica* and *P. Ajowan* probably yielded the seeds which formed the *Ammi* of the antients. Botanists and inquirers into the plants, condiments, and medicines of the antients, have usually sought too exclusively in Europe for what was frequently derived from the East. Dioscorides states that the Æthiopic Ammi is called Cumin by some, and that it is thought to be distinct from the royal kind. The seeds of one kind were sent by Forskäl to Linnæus, who named the plant Ammi copticum. This has now been removed to the present genus Ptychotis. Arabian authors give Nankhwah as the synonym of Ammi, and Persian authors consider Ajwain to be a synonym of the former. It is remarkable, according to Dr. Royle, that there is also an Indian plant which is everywhere called Ajwain, and celebrated for its aromatic smell, pungent taste, and for its employment both by natives and Europeans for culinary and medicinal purposes; so much so, that Dr. Roxburgh could not conceive that 'this famous Indian plant should be unknown to European botanists.' Dr Royle says, 'in Persian works in use in India the Arabic Nankhwah is given as a synonym of the Indian Ajwain, as it is also of the Greek Ammi.'

The Indian species has been referred by De Candolle to the genus Ptychotis, and called by him P. Ajowan, stating that it was very closely allied to *P. coptica*, which we have seen was considered to be one kind of Ammi—the two kinds described by Dioscorides being Cuminum Æthiopicum and regium. The latter name is translated by the Persians *Kumoon Mullooke*, or royal Cumin, and given as a synonym of the Nankhwah. The Indian and Egyptian kinds of Ptychotis, as ascertained by modern botanists, are therefore most probably the two kinds of Ammi of Dioscorides. These afford interesting instances of the results to be obtained by closely examining the products of nature possessed of any remarkable properties, in the countries where they are produced, and continue to be used, and whence they were probably first obtained by the antients.

PTYCHOZO'ON. [Gecko, vol. xi., p. 105.]

PTYODA'CTYLUS. [Gecko, vol. xi., p. 105.]

PUBERTY (*Pubertas*), the age at which the period of boyhood or girlhood ends, and that of adolescence begins. [Age.] The word is derived from *pubes*, which in its primary signification means the down or soft hair that generally begins to grow on young people about that time. Puberty appears at various ages, according to the climate, the circumstances connected with education, and the constitution of the individual. The usual period in this country is from the twelfth to the fourteenth year for females, and from the fourteenth to the sixteenth for males. In the northern parts of the island it is often a year or two later in both sexes. It is often observed earlier in boarding-schools both in respect of males and females. In the latter (in London or its vicinity) I have, says Dr. Copland (*Dict. of Pract. Med.*, art. 'Age') not unfrequently met with instances of puberty at ten and eleven years, especially in sanguine and plethoric constitutions; and where the apartments, particularly those for sleeping, have been crowded and close. Women in all countries reach the period of puberty one or two years before men; and the inhabitants of warm before those of cold climates. In the hottest regions of Africa, Asia, and America, girls arrive at puberty at ten, or even at nine years of age; in France not till thirteen, fourteen, or fifteen; whilst in Sweden, Russia, and Denmark this period is not attained till from two to three years later.

Occasionally however an extraordinary precocity exhibits itself in the development of sexual organization and power both in males and females. It is not necessary to dwell at any great length upon instances of exemplification, which may be traced in great numbers in the writings of physiologists who have been curious upon this subject. Those who are desirous of doing so may turn to the 'Journal des Sçavans' for 1688, and the 'Philosophical Transactions' for 1745. In the former Boisset gives an instance of this precocity in a boy of three years old; in the latter, the subject in the case recorded was two years and eleven months. A similar example at a similar age is well known, says Dr. Good (*Pract. of Med.*,' Præcotia Masculina'), to have occurred only a few years since in a boy who was exhibited by his friends for money to medical practitioners in London; and may be found, together with various others, minutely described in the first volume of the 'Medico-Chirurgical Transactions.' Two, of late date, are also detailed in the eleventh and twelfth volumes of the same work, by Dr. Breschet and Mr. J. F. South. In the year 1741, Mr. Dawkes, a surgeon at St. Ives near Huntingdon, published a small tract, called 'Prodigium Willinghamense,' or an account of a surprising boy, who was buried at Willingham, near Cambridge, upon whom he wrote the following epitaph:—'Stop, traveller, and wondering know, here buried lie the remains of Thomas, son of Thomas and Margaret Hall, who, not one year old, had the signs of manhood; not three, was almost four feet high; endued with uncommon strength, a just proportion of parts, and a stupendous voice; before six he died, as it were, of an advanced age. He was born at this village, October 31, 1741, and in the same departed this life, September 3, 1747.' (See also 'Philos. Trans.,' 1744-5.) As Dr. Elliotson has observed (Blumenbach's *Physiology*, 4th ed., p. 535, note), this perfectly authentic case removes all doubts respecting the boy at Salamis, mentioned by Pliny (*Hist Nat.*, lib. vii., cap. 17), as being four feet high, and as having reached puberty when only three years old; and respecting the person seen by Craterus, the brother of king Antigonus, who, within seven years, was an infant, a youth, an adult, a father, an old man, and a corpse. (Phlegon, *De Mirab.*, cap. 32.)

Females also may acquire a similar precocity to that of males; and we have numerous and well authenticated instances of pregnancy itself occuring at the early age of nine years. (See references in Dr. Good's *Pract. of Med.*)

At the time of puberty in the male, the larynx enlarges, the quality of the voice is changed, the beard grows, the chest and shoulders enlarge, and the power of procreation commences. In the female, the breasts and pelvis enlarge, the uterine organs are developed, and a peculiar periodic discharge from the uterus commences, which continues, subject to certain suspensions during pregnancy and lactation, as long as the organ is capable of impregnation, or, on the average, about thirty years The period which commences with puberty is, both as regards the mind and the body, one of the most important epochs of human existence; for, says Dr. Copland (*loc. cit.*), during it the natural development of the sexual organs imparts a health and tonic excitement throughout the economy, bringing to their state of full perfection all the organs of the body, and all the manifestations of mind, excepting those that are derived from experience. The organs of respiration and voice have acquired their full growth and tone, the muscles their due proportion, and the cerebro-spinal nervous system its beautiful organization; placing man, by the exercise of its admirable functions, at the head of all animated creation—the dread of all other animals, the wonder of himself. It is chiefly during this period of life that the mind becomes stored with ideas, derived both from the learning of the antients, the science of the moderns, and the arts and accomplishments of highly civilised life; and is more particularly and more ardently engaged in decomposing the information thus acquired, and recombining it in new and useful and attractive forms.

PUBLICA'NI. The publicani were a body of persons in the Roman state who farmed the public revenues (vectigalia), from which circumstance apparently their name is derived. ('Publicani autem dicuntur qui publica vectigalia habent conducta,' *Dig.*, 39, tit. 4, s. 12.) They were numerous as early as the sixth century of the republic, and they continued to exist under the emperors. The publicani formed various societies or partnerships, which had a corporate character. The persons who were members of these societies were chiefly of the equestrian order, and the whole body was so numerous and wealthy as almost to constitute a separate class in the state. Each societas had a magister, or chief manager, at Rome, and a deputy magister (promagistro), with numerous associates and assistants, in the provinces. [Provincia.] The revenues, which were chiefly leased to the publicani, were tolls, harbour duties, and the scriptura, or the tax that was paid for the use of the public pasture-lands. The publicani had their under-lessees (portitores, τελῶναι, *Luke*, v. 27, 29) and collectors. Numerous slaves were also employed by them in collecting the taxes; and this body of men was comprehended under the term of a 'familia publicanorum.' In the prætor's edict however (*Dig.*, 39, tit. 4, s. 1), which was specially directed against wrongful acts of the publicani, the term 'familia' was interpreted as comprehending all who aided them in collecting the vectigal, whether slaves of their own, of other people, or free men. In our translation of the New Testament these inferior officers are called 'publicans,' and are mentioned together with 'sinners,' a distinction to which they might be partly entitled for their occasional oppressive conduct, and partly to the general dislike of all the world to tax-collectors. It appears that Matthew, who was a Jew, was a publican (*Matth.*, ix. 9), from which circumstance, and from all reasonable probability, it may be concluded that natives of a province were employed as collectors, and probably farmed the revenues of small districts from the great Roman publicani. Indeed it is not easy to conceive how the services of natives could have been well dispensed with.

The publicani undertook to pay fixed sums for the taxes of a particular district or place. The contract was often made by a single person on behalf of himself and others. It was the business of the censors to let the taxes. The publicani gave security to the state for the due performance of their contract; and their property, as well as that of their sureties, was liable to the amount of their obligations.

Among the remedies which the publicani had against those who were bound to pay vectigal, was the 'pignoris captio,' which seems to have been a kind of distress (Gaius, iv. 28); but after the old forms of action were changed, it was not usual actually to seize the property, but a fiction was introduced into the formula, by virtue of which the person who owed the vectigal might be condemned in a sum of money equal in amount to what he must have paid in order to redeem his property if it had been seized.

PUBLI'COLA, PU'BLIUS VALE'RIUS. His original name was Publius Valerius, and the surname Publicola was given to him as a distinction for his republican virtues. He was of Sabine origin, and the son of Volesus. During the tyrannical government of Tarquinius Superbus, he is said to have been distinguished for his riches, wisdom, and affability. The first time that we find him taking an active part in the affairs of Rome was shortly before the expulsion of the Tarquins, when, with Sp. Lucretius, he went from Rome to Collatia to avenge the violence done to Lucretia. He strenuously assisted Brutus in effecting the banishment of the Tarquins (Plut., *Publ.*, i.; Liv., ii. 2); and when, after the establishment of the consulate, Tarquinius Collatinus had resigned his office, P. Valerius was appointed consul in his stead. In the ensuing war of the Tarquins, who were aided by the Veientines and Tarquinians, Valerius commanded the Roman infantry, and gained a great victory near the forest of Arsia (509 B.C.): Brutus, his colleague, fell in the battle. Valerius, with the spoils of the enemy, returned to Rome in triumph (Liv., ii. 7; Plut., *Publ.*, 9), where on the next day he solemnised the obsequies of his colleague. Valerius now had no colleague appointed in the place of Brutus, and he wished to remain sole consul, that he might not be thwarted in his plan of confining the consular power within proper limits. The election was thus delayed, and when, in addition to this, he built a stone house on the top of the hill Velia, which looked down upon the Forum, near S. Francesca Romana, he excited among his fellow-citizens a suspicion that he aimed at the kingly power. He himself in his innocence was unconscious of the feelings which he was exciting, and as soon as he was made aware of the rising suspicion, he appeared before the assembly of the people (populus), and, as a sign of respect, lowered before them his fasces, from which the rods had been previously taken out. He then addressed the people, and, to convince them of his innocence, he stopped the building, and ordered the part which was already finished to be pulled down. The people, thus ashamed of their unfounded suspicions, granted him a piece of ground at the foot of the Velia, where he might build his house, and at the same time the privilege of having the doors to open out into the street, while the doors of all other Roman houses, like our modern doors, opened into the house. The respect which he had shown to the populus, whom he had clearly acknowledged as the source of his power, procured him the name of *Publicola*. He still remained sole consul, and now began to carry out his plan. He first filled up the vacancies in the senate which had occurred during the late revolution by adding 164 senators (Niebuhr, *History of Rome*, i. 525, &c.), and then carried several laws to prevent the restoration of the kingly government; he also secured to the plebeians the right of appeal to a tribunal of their own order from a sentence pronounced by the consul which inflicted bodily punishment. (Plut., *Publ.*, 11; Liv., ii. 8; iii. 55; x. 9.) He is also said to have established a public treasury in the temple of Saturn, for the management of which two quæstors (treasurers) were appointed. (Comp. Niebuhr, *loc. cit.*) After he had introduced these beneficial and popular measures, he held the comitia for electing a successor to Brutus. The curies appointed Sp. Lucretius, who, being at a very advanced age, died a few days after, and in his place was elected M. Horatius Pulvillus, who at the close of the year was re-elected to the consulship along with P. Valerius (508 B.C.). Respecting the difficulties connected with the first consulship of Valerius and his several colleagues, see Niebuhr, 'Hist. of Rome,' i. 535, &c. In the war with the Etruscans [PORSENA] which broke out in this year, Publicola and his colleague were wounded, and the Romans retreated across the Tiber, within the city. But Publicola subsequently made great havoc among the Etruscans by a stratagem. The celebrated census of Publicola (Dionys., *Hal.*, v. 293, ed. Sylburg), at which 130,000 adult Romans were registered, is said to have taken place in the second consulship of Publicola. During the siege of Rome by Porsena (Plut., *Publ.*, 17), or, according to Livy, after the battle of Aricia, Publicola was made consul a third time, with P. Lucretius (507 B.C.). It was in this year, according to the tradition followed by Plutarch, that Porsena attempted to negotiate for the restoration of the Tarquins, to which Publicola offered the most determined opposition. Among the hostages given to the Etruscan king was Valeria, the daughter of Publicola, and it was he who sent the maidens back, when, headed by Cloelia, they had made their escape.

Towards the end of this year the Sabines invaded the Roman territory, upon which M. Valerius, brother of Publicola, and P. Postumius, were appointed consuls. Marcus, aided by the advice and the presence of his brother, gained two victories, and in the last battle he slew 10,000 of the enemy without any loss on the Roman side. For this Marcus received great rewards, and was honoured with the same privilege as his brother, of having the doors of his house open into the street. (Plut., *Publ.*, 20.) But when the Sabines, after their defeat, united their forces with those of the Latins, and the danger thus became more threatening, Publicola was made consul a fourth time, together with T. Lucretius. The consuls set out against the enemy, who were already weakened by the desertion of some of the leaders, and, after ravaging the country, they gained a battle, in which the enemy was so much reduced that he ceased to be formidable, and the consuls, with rich spoils and numerous captives, returned to Rome in triumph. After this triumph, the new consuls for the following year were elected, and Publicola soon afterwards died, or, according to Plutarch, put an end to his own life. Niebuhr thinks that, according to the original legend, Publicola died in the battle of Regillus, 496 B.C. He was buried at the public expense, which must be considered as an honourable distinction, and not, as Livy thinks, as a proof of his poverty, and the Roman matrons mourned for him a whole year, as they had done for Brutus. The citizens decreed that the body should be interred within the city near the Velia, and that the whole house of the Valerii should enjoy this same privilege, for which however, in subsequent times, a symbolical ceremony was substituted.

The real history of Publicola is entirely disfigured, and has come down to us in the garb and with all the embellishments of poetry. The fact that Publicola is represented consul for three successive years, together with the fact that he pulled down his house on the hill Velia, and the extraordinary distinctions granted to him and other members of his house, have led Niebuhr to suppose that, after the banishment of the Tarquins, the Valerian house for a time possessed the right of exercising the kingly power, for and on behalf of the Tities, by one of its members; and he looks upon Publicola's taking up his residence at the foot of the Velia as a pledge of his intention to exercise his royal authority as befitted a citizen. (Niebuhr, *Hist. of Rome*, i., p. 538.)

PU'BLIUS, SYRUS, a native of Syria, was brought when a boy to Rome as a slave, but he met with a kind master who took care of his education, and eventually gave him his freedom. He excelled in writing mimi, which were in great vogue at Rome in the latter times of the republic. [MIMES.] Publius lived in the time of Julius Cæsar, who on a public occasion gave him the preference over Laberius and other contemporary mimographers. (Aulus Gellius, xvii. 14.) Publius appears to have been more correct and moral in his writings than authors of mimi generally were. St. Jerome (*Epistola ad Lætam*) says that the Romans used to read his works in their public schools. His works are lost, but several of his moral apophthegms, which have been preserved by Seneca, Gellius, and other antient writers, are remarkable for their laconic precision and justness of sense. They have been collected and printed at the end of several editions of Phædrus.

PUCCI'NIA, a genus of Fungi well known to farmers under the name of mildew. It is distinguished from other parasitical genera by its spore-cases being elevated upon long slender stalks and divided internally by one or two horizontal partitions into two or three separate cavities; the spore-cases arise from a spawn or matrix which is dispersed among the living tissue of the plant on which they grow. A considerable number of species have been distinguished by writers on fungi, and thirty-eight are enumerated as inhabitants of this country. They all grow upon the living leaves or stems of plants, and are generated in their interior, bursting through the epidermis when ready to scatter their seeds or spores; by what means the latter are introduced into the tissue has never been satisfactorily explained: some writers imagine the seeds to be introduced through the stomates from the atmosphere where they float; but it seems more probable that they are absorbed by the young roots, and carried upwards in the current of vegetation, a mode of introduction which their extremely small size renders quite possible. The mildew of corn is the *Puccinia graminis*, which makes its appearance on the straw and leaves in the form of dark grey or black lines and patches, broken in outline in consequence of their running irregularly together. Each line consists of numerous minute spore-cases, which are individually black when quite ripe. The plant appears in all corn-fields in all seasons, but its injurious effects are only observed in wet seasons, or in places where, from whatever cause, the straw becomes very rank; in the latter instance, the spore-cases, from their great abundance, attract from the straw the fluid food which was intended for the support of the grain, intercepting it in its passage upwards, and thus cause the ruin of the crop. In a disease of this kind there seems no hope of discovering a remedy, for the earth is undoubtedly well stored with the spores of Puccinia in all places and in all seasons.

PUCCOON. This name is given in the United States of America to a red vegetable pigment employed by the Indians, and hence has been transferred to the plant that produces it. By some it has been ascribed to Sanguisorba Canadensis; but Pursh asserts that it is obtained from the root of Batschia canescens, a Boraginaceous plant, while the American writers with one accord apply the name to Sanguinaria Canadensis, a Papaveraceous plant, whose roots yield, when wounded, a deep orange-red fluid.

PUDDING-STONE. [CONGLOMERATE.]

PUEBLO. [MEXICAN STATES.]

PUERPERAL DISEASES. Under this term are included all those diseases which arise out of the state of pregnancy: they are not however, as the name would seem to imply, peculiar to this condition, but incidental only; and they are so far modified by it as to require some allusion to their character and mode of treatment. Among the most alarming of these diseases, and the earliest to make their appearance, are puerperal convulsions; they consist of epileptic seizures, and their character differs in no respect from the ordinary epileptic fits already described in the article EPILEPSY: we therefore shall merely observe in the present place, that convulsions are liable to occur at any time after the sixth month of utero gestation; but, for the reasons about to be stated, the majority of cases are met with during labour. When they occur after delivery, they are generally connected with a loaded state of the large intestine, or with a state of exhaustion from hæmorrhage. The cause of these attacks must be looked for in the state of the viscera and large blood-vessels at this period: during gestation, these parts are subjected to a constant and increasing degree of pressure from the gravid uterus, the natural tendency of which is to produce local congestion of the circulating fluid, and an undue accumulation of the excretions within the intestines. At the time of parturition this pressure is materially augmented by the contractile efforts which are made to expel the infant; and the mechanical obstacle thus offered to the flow of blood through the abdominal aorta, determines it in unnatural quantity to the brain. Hence this state of things, if not remedied, may not only produce the disease we have just been considering, but may even give rise to apoplexy. The treatment is obvious, and consists in relieving the vascular system by general and topical bleeding, and unloading the intestines by brisk cathartics.

But by far the most important and the most dangerous of puerperal diseases is puerperal peritonitis [PERITONITIS], called also puerperal inflammation, puerperal fever. It usually attacks women a few days after delivery, and seems to have no connection with the duration or the severity of labour. This fatal disease varies so much in the type of the inflammation as to be scarcely recognised as the same affection in different individuals and at different periods, the accompanying fever being sometimes strictly inflammatory, and at other times typhoid. In its most dangerous form it is characterised by a remarkable prostration of the vital powers, and by a countenance expressive of extreme anxiety and distress. The pulse is frequent and feeble; the abdomen tympanitic, and unable to bear the slightest pressure; the bowels are constipated, and vomiting is not an unfrequent attendant. As the disease proceeds, the lochial discharge and the secretion of milk are suppressed; and towards its termination, a total cessation of pain sometimes occurs, and the patient dies, often in full possession of her consciousness to the last. This severe form of puerperal fever is most frequently epidemic, and many believe it to be highly contagious. The lesions met with in this disease are chiefly manifest in the peritoneum; but in the worst cases, the substance of the uterus itself, and the large veins in its vicinity, present evidences of inflammation. The treatment of puerperal fever is peculiarly difficult 'every case,' observes one of our most celebrated accoucheurs, 'must be isolated and studied alone, and looked at by itself, and its management must depend upon its type and its stage.' Bleeding, general and topical; counter-irritation, by means of blisters or spirits of turpentine, applied to the abdomen; purging, by the exhibition of the last-named medicine, or by large doses of calomel; and the latter, given to excite ptyalism, have been the principal remedies used for combating this formidable malady. But the prostration of the vital powers is, in some cases, so extreme, as to afford us little chance of putting into requisition the only means which we possess of combating the inflammatory symptoms.

A form of disease sometimes occurs after delivery, which, from its resemblance in some particulars to the one we have just alluded to, requires notice. It is due to stomachal and intestinal irritation; and is ushered in by rigors, followed by great heat of skin, a full and frequent pulse, and loaded tongue. The abdomen may be tumid and painful on pressure, and the head may be affected by symptoms of phrenitis, as intolerance of light, noise, wakefulness, and delirium. The affection of the head and that of the abdomen frequently coexist or alternate in the same case, and this conjunction of the two affections serves to assist in the diagnosis between peritonitis and the present complaint. As it is of the greatest importance in a therapeutic point of view to distinguish puerperal inflammation from intestinal irritation, much may be learnt by the exhibition of large injections of warm water, an examination of the evacuations, and an observation of the effects thus produced upon the disease. In intestinal disorders, the fæces will be found to be scybalous, or at least offensive and dark-coloured, and in large quantities; and the relief obtained will be found to depend upon the proper evacuation of the bowels. Another characteristic of intestinal irritation is the susceptibility to fainting upon blood-letting. The treatment of this disorder may be summed up in the words of Dr. Marshall Hall. 'In peritonitis,' he observes, 'the freest blood-letting must be aided by purgative medicines; whilst in intestinal irritation, the freest and fullest evacuation of the intestines must be aided by blood-letting; for although both blood-letting and purging are to be used in every case, yet the former is the remedy in inflammation, and the latter in intestinal irritation.' In describing the last-mentioned disease, we have alluded to the combination of cerebral symptoms, which so frequently are present. This disturbance of the intellectual functions is sometimes so great and so continued, as to lead to the supposition that the brain is the seat of some active inflammatory disease; and were we, acting upon this supposition, to have recourse to antiphlogistic remedies only, we should probably lose our patient. This alarming disorder has been termed puerperal insanity, or puerperal mania. It comes on rather insidiously: there is a little excitement during the day and sleeplessness at night; then delirium, and then actual mania; the pulse is somewhat accelerated, the tongue furred, the skin hot, the bowels costive, and the secretion of milk diminished. It seems to arise from a combination of causes acting upon an originally irritable temperament, but rendered still more so by intestinal disorder and hæmorrhage, or by the debility consequent upon suckling. Blood-letting in these cases is generally fatal; the treatment consists in regulating the bowels and preserving extreme quiet of mind and body, with a nutritious but not stimulating diet. When speaking of puerperal fever, it was observed that the large veins in the vicinity of the uterus frequently presented traces of inflammation. Uterine and crural phlebitis however occurs as a distinct disease, and has been described under the terms of phlegmasia dolens, œdema puerperarum, the white swelling of lying-in women, &c.; but it is only within a few years that the true nature of this disease has been fully understood, having been first pointed out to the profession by the late Dr. Robert Lee. It may appear as early as the fourth day after delivery; but, in the majority of cases, it is not till the second or third week that it makes its appearance; and, in many instances, attacks women who are recovering from puerperal fever. It is ushered in with rigors, and these are succeeded by heat, thirst, and other symptoms of pyrexia. There is a sense of pain, first experienced in the uterine region, and gradually descending in the course of the iliac and crural veins down one leg, accompanied by swelling, and great tenderness upon pressure along the course of the vessels, which are hard as a cord, and roll under the fingers. In some cases an erythematous redness of the integuments of the limb is met with; but in the majority they are smooth, shining, tense, and colourless. The power of moving the limb is completely lost, and it is greatly and uniformly swollen throughout its whole extent. Sometimes, after the inflammation has subsided in one limb, the other is attacked in a similar way. The pain and febrile symptoms usually diminish within a few days after the occurrence of the swelling; but sometimes the pain is excruciating throughout the whole period of the acute stage of the disease. The duration of the acute stage is various in different individuals; in the greater number of cases it terminates in two or three weeks; but the limb still remains powerless and œdematous. In some women the limb does not return to its natural state for many months, or years, or even during life. The appearances on dissection which are met with in this disease are similar to those which characterise inflammation of the veins generally. The causes of this affection are supposed to be owing to the orifices of the veins in the lining membrane of the uterus being left open after the separation of the placenta, by which a direct communication is established between the cavities of these veins and the atmospheric air. The treatment of phlegmasia dolens consists in the local abstraction of blood by leeches applied to the groin, and in the course of the large venous trunks of the limb; hot fomentations to the part, and the administration of diaphoretics and saline purgatives. After the inflammatory symptoms have subsided, the limb may be supported by a bandage, and slight frictions made use of. There is a disorder occasionally met with in the puerperal state, which, from not being mentioned in the article Hæmorrhage, must be alluded to in this place. The symptoms about to be detailed are owing to loss of blood, uterine hæmorrhage during and shortly after parturition being not an unfrequent occurrence. The more immediate effects of hæmorrhage are fainting; and where the loss of blood has been great, this symptom is sometimes so prolonged as to be not only dangerous, but fatal. It is the more remote consequences of loss of blood that we are to speak of in this place: we have seen already how a combination of this with intestinal disorder and other irritating causes gives rise to puerperal mania; we shall now view the effects of hæmorrhage as they are met with uncombined with the conditions previously alluded to. This condition of system has been called by the French pathologists a state of anæmia, and is characterised by a pallid condition of the skin; great nervous excitability; a throbbing of the temples; vertigo; tinnitus aurium; a frequent, jerking, compressible pulse; a great tendency to faint on the slightest exertion, or in the upright position; palpitation of the heart; halitant respiration; and, generally, great thirst. The treatment to be adopted in anæmia from loss of blood, consists in maintaining a perfect quiet of mind and body, in a free exposure of the patient to fresh air, a mild but nutritive diet, and a regular but not an over-active state of the bowels. The symptoms we have just enumerated as arising from loss of blood are sometimes met with, in a mitigated form, at a much later period of the puerperal state, and arise from the drain occasioned by super-lactation. The treatment of these cases is more simple, and consists generally in the weaning of the child, the adoption of a more nutritive diet, and change of air. With respect to what are called milk-abscesses, they arise from the inflammation consequent on over-distention of the lactiferous tubes, and require the same mode of treatment as is adopted in abscess when it occurs in other parts than the breast. [Abscess.] They are best prevented by permitting the infant to suck within a few hours after delivery, and by repeating this act frequently. When the secretion of milk is excessive, the bowels should be kept freely open by saline purgatives.

PUERTO BELLO. [Panama.]

PUERTO CABELLO is a town and port in the republic of Venezuela in South America, and in the department of the same name, in 10° 20′ N lat. and 69° 10′ W. long. It is situated on the north coast of South America, and is considered the best port on the south coast of the Caribbean Sea. A narrow low island extends about two miles east and west. It is overgrown with mangrove-trees, and at its eastern extremity is united to the continent by a shoal. To the south of this island is the harbour, which is formed on the west by a peninsula projecting northward and terminating about 100 yards from the island. The space between the peninsula and island forms the entrance of the port, which is deep, but so narrow that only one vessel can pass through it at a time. The small bay, of which the northern part forms the harbour, extends southward, and at its extremity turns south-west. The southern portion of it contains several islands overgrown with mangrove-trees. The harbour itself is deep and spacious, and the largest vessels may lie there in safety; for though a heavy surf breaks along this coast of South America, its force is broken by the intervening island, and as the entrance of the harbour is from the west, the surf does not penetrate to the interior. Accordingly the water of the harbour is always as smooth as that of a lake. The town consists of the city and of the suburb. The city is situated on the northern part of the peninsula, through which a cut has been made, by which the site of the city is converted into an island. It is small, but contains several good houses, and is well fortified. Neither the church nor any of the public buildings require particular notice. There are some good warehouses, and an excellent wharf faced with stone, both erected by the Guipuzcoa Company, when it had obtained the right of exclusive commerce with this part of America. Vessels of large burden lie close to the wharf, and as they can be easily and securely fastened to the shore, anchors are seldom required. To this circumstance it is said the harbour owes its name, as implying that vessels may here be secured by a single hair (*cabello*); but Humboldt asserts that it acquired this name from one Antonio Cabello, who carried on an extensive illicit traffic with Curaçao before the Guipuzcoa Company built a town here. Over the cut which separates the city from the suburb is a bridge of wood, and a gate on it, which is shut every night. The suburb is much more extensive than the city, but built with less regularity. The houses are low, only a few of them having an upper story. It is the residence of the merchants and working people. Both places contained at the beginning of this century a population of 9000. Later accounts are wanting. The commerce of the town is considerable, and the produce of the fertile countries lying to the south of it, as the valley of Aragua and the plain of Valencia, is exported from it. The exports consist of cacao, coffee, sugar, and a great number of mules. Formerly 10,000 mules are said to have been annually shipped for Jamaica and other parts of the West Indies. The principal commercial relations of Puerto Cabello are with Jamaica and Curaçao, but as to this matter also more recent information is wanting.

(Humboldt's *Personal Narrative*; Depons, *Voyage à la Partie Orientale de la Terre Ferme*; Semple's *Sketch of the Present State of Caracas*.)

PUERTO DE SANTA MARIA, or St. Mary's Harbour, the 'Portus Menesthei' of the antients, is a large seaport of Spain, in the province of Cadiz, five miles north-east of that city, at the mouth of the river Guadalete. The town is well built, well paved, and kept very clean. The Calle Larga, or Long Street, which is about a mile in length, has a very handsome appearance, owing to the number of fine shops and elegant buildings. The public walk, called Paseo de la Victoria, is a very agreeable spot during the hot summer days, when it is very much frequented by the inhabitants. There is also a beautiful public garden on the banks of the Guadalete planted with all sorts of exotic trees. The quay is well contrived, but large ships cannot come up to it, on account of the numerous sand-banks by which the mouth of the river is obstructed. On the west side of the town there is a very fine prospect of the bay and town of Cadiz, which, seen from an eminence on the road to Xerez, looks as if it rose out of the waves of the ocean. The principal church, a building of tolerable antiquity, is chiefly remarkable for a profusion of gorgeous ornaments not in the best taste, as well as for a few pictures by the best masters of the Sevillian school. There are within the town six convents for men and three for women, but these have been shut for some time. This town is the capital of a considerable district, and is occasionally the place of residence of the civil and military authorities of the province of Cadiz. The climate is excellent, having little either of the severity of cold in winter or scorching heat in summer, for which reason the wealthy inhabitants of Cadiz make it their place of residence during the summer. The only manufacture of consequence at present in the town is soap, of which large quantities are yearly exported. There are also a few manufactories of hats and one or two brandy-distilleries. The land around the town is in a tolerable state of cultivation, and yields abundant crops of corn, oil, and wine, which last article is imported into England under the name of sherry. Puerto de Santa Maria is the birth-place of José Cordero, a Franciscan friar, who made the clock in the tower of the cathedral of Seville, and of Enziso Monzon, who translated the whole of Virgil into Spanish verse, Cadiz, 1698, 4to. Lat. 36° 31′ 8″ N.; long. 6° 18′ W.

PUERTO REAL, a town in the south-west of Spain, in the province of Cadiz, five miles east of that city, and on the bay of Cadiz. It was founded by Ferdinand and Isabella during the Moorish war, whence its name 'Royal Harbour.' The streets are airy, clean, and straight, and the houses well built, with flat roofs. The market-place, which is situated in the centre of the town, is a spacious square surrounded by stone arcades, under which all sorts of provisions are exposed for sale. There is also a very handsome stone pier and several commodious wharfs of the same material for the unlading of ships. Close to one of the latter is a large reservoir, from which water is daily conveyed to Cadiz for the supply of the town and the ships in the bay. During the Peninsular war, the French erected their batteries against Cadiz at Puerto Real. The population, which at the beginning of the last century amounted to nearly 7000, is now reduced, according to Miñano's estimate, to 3000. There is little or no trade, except in salt, this being the great depôt of all that which is collected between the island of Leon and the bay of Cadiz.

PUERTO RICO, an island of the West Indies, belonging to Spain, is the smallest of the Greater Antilles, and the most western of the Leeward Islands. The name of Leeward Islands is derived and corrupted from the old Spanish navigators, who divided the islands into two classes, Bantovento and Sotavento, the former comprising all the Caribbee Islands, and the latter Cuba, Jamaica, San Domingo, and Puerto Rico. The English have applied both names to the Caribbee Islands, the Windward Islands extending from Trinidad to Martinique, the Leeward Islands from Dominica to Puerto Rico.

This island is in the form of a parallelogram, 84 miles long and 35 broad, and it contains about 2940 square miles. It lies between 17° 50′ and 18° 30′ N. lat., and 65° 39′ and 67° 11′ W. longitude. The population, in 1836, was 357,086. Puerto Rico is bounded on the north by the Atlantic, on the west by the Mona Passage, which separates the island from San Domingo, with a width of about 75 miles, on the south by the Caribbean Sea, and to the east lie the Virgin Islands.

A range of mountains of considerable height runs through the centre of the island; the highest part is that of Luguilla in the north-east. The Yungue, the most elevated peak, is about 3700 feet high. From the central chain many inferior ridges run north and south, containing between them valleys of great fertility watered by rivers; these valleys widen as they approach the sea. The valleys of the north side produce the best pasturage; those of the south grow most sugar. The coast abounds with harbours: those on the north coast are generally unsafe during the prevalence of the northerly winds, in consequence of the heavy surf which then rolls in upon the shore. The same cause creates bars at the mouths of the rivers on the north coast. The port of San Juan is however perfectly sheltered by the narrow island on which the town and fortress stand. Aguadilla is an open roadstead at the north-west extremity of the island and much exposed, but from its position and the abundant supply of provisions and water which it affords, it is much visited. It was here that Columbus effected his first landing in Puerto Rico. The ports of Guanica and Jobos on the south coast are very large, afford excellent anchorage, and are easily defended. Few countries are so well watered by rivers as Puerto Rico. Seventeen rivers rising in the central chain run into the sea on the north coast, of which the rivers Manati, Loisa, Trabajo, and Arecibo are deep and broad: though there are bars at their mouths, small vessels with cargoes can safely cross them at high water. Nine rivers fall into the sea on the east coast, sixteen on the south, and three on the west, where also there are several fresh-water lakes that communicate with the sea. These rivers are well stocked with fish. During the last sixteen years many good roads have been constructed and bridges built. The principal roads are from San Juan to Aguadilla and Mayagues, from Ponce to Guayama, and from Faxardo to the capital; they are of solid construction, being of gravel or stone cemented. The greater number of bridges are of wood, but several are of stone.

The soil of Puerto Rico is of the richest and most varied description; there is the deep rich soil required for the cultivation of the sugar-cane, the cool mountain valley for the coffee plantation, the most luxuriant pasture, the moist spot favourable for the cocoa-nut and the irrigated rice-field. The pasture-lands are principally on the north and east coasts; the cane-fields on the south and west. In 1830 there were 109,478 acres under cultivation, and 634,506 in pasturage. The quantity of sugar produced in 1830 was 414,663 quintals, which at the rate of 4 dollars a quintal will give 1,658,652 dollars. Capital is continually directed to this island, and fresh land is taken into cultivation yearly to a large amount. The proportion of sugar produced from an acre is very great compared with the produce of the other West India islands, the produce of Jamaica being about 10 quintals; Granada, 15 quintals; St. Vincent, 25 quintals; and Puerto Rico, 30 quintals to the acre. About 14,000 head of horned cattle are annually exported and 23,000 consumed in the island; the price is about 100 dollars for three full-grown bullocks.

The climate of Puerto Rico seems to be more favourable to Europeans than that of most of the other islands in the West Indies. According to a table given by Colonel Flinter from the observations of Don José Vertéz, on an average of five years, the maximum height of the thermometer is 92° Fahr., in the month of August, and the minimum 80°, in December, taken at noon. The salubrity may be partly ascribed to the very general cultivation and the absence of stagnant waters. There are two rainy seasons: the first commences in May and lasts about twenty days, when the sky clears up, the sun shines unobscured, and a perfect calm lasts till about 11 A.M., when the sea-breeze sets in. June and July offer little variation. August is the hottest month; the heat is then suffocating, the sea-breeze has died away into a calm, only occasionally broken by a faint breeze, and the night brings no relief, for there is no land-wind. This is the most sickly season for Europeans. This island suffered much from a hurricane on the 27th of August, 1825. About September the clouds have again gathered, and the rain pours down in torrents such as can scarcely be conceived by those who have not witnessed it. In a few hours from the commencement of the rain the rivers have overflowed, and the low lands are completely inundated. The quantity of rain which falls during the year in Puerto Rico has not been ascertained by actual measurement; in the island of Barbadoes, where it is much less, the quantity is about seventy inches. In October the weather becomes much cooler. In November the north and north-east winds set in, and blow till January, during which months the weather is occasionally cool.

Puerto Rico was discovered by Columbus in 1493. The natives, knowing that the Spaniards had subjugated S. Domingo, looked on them as beings of a superior order, and submitted to them for some time, when, having by experience discovered the fallacy of their opinion, they rose on the Spaniards and slaughtered many of them. On this the Spaniards exterminated the greater part of the natives, and the remainder have become so intermixed with the conquerors, that there is no mark of distinction between the [illegible]

The island now contains fifty-eight towns and villages. San Juan, the capital, contained, in 1828, 800 houses of brick and stone: it is situated on the north side of the island, in 18° 29′ N. lat. and 66° 13′ W. long. San Juan is built on a narrow island connected at one end with the mainland by a bridge. The town is placed on the slope of a hill, and has regularly built streets, which cross each other at right angles. It is enclosed by strong fortifications, and contains about 30,000 inhabitants. The harbour lies between the town and the mainland. S. Juan is the seat of government. The chief public buildings are, the cathedral, a large unfinished building, a theatre, military hospital for 350 patients, another for females, a gaol, a house of correction, whose inmates labour at the public works, a town-house, which is a handsome building, an arsenal, and a custom-house. There are four churches and two chapels. A British force under Sir Ralph Abercromby made an unsuccessful attempt to carry this place in 1791.

Mayagues and Aguadilla on the west, Ponce on the south, Humacao on the east, and Pepino and Cayey in the interior, are considerable towns. The rest are very small, consisting generally of a large square with a church and a few straggling houses.

The government of Puerto Rico is administered by a captain-general, who has the supreme military command, but his civil authority is in some degree controlled by an officer who is called his legal adviser; and who is appointed to assist the governor and give decisions in those cases with which it is not supposed that a soldier can be conversant, and for the correctness of which the legal adviser is responsible. The governor must however sign the decision or sentence before it is valid, and he may act contrary to the opinion of the adviser, at his own risk. The court of royal audience is invested with the superintendance of all other authorities, and is consulted by the governor on all important occasions. The intendant is an officer ranking as a major-general, whose duty it is to watch over the revenue. There are two courts of cabildo in the island, which superintend the police and municipal affairs. The governor is president of it. The court is composed of two alcaldes, elected annually, a regidor, and a syndic. They decide all causes under 100 dollars. In each of the seven towns and villages which form the head of a department, a magistrate resides called the alcalde mayor. In the smaller towns there are inferior magistrates, who are annually appointed by the captain-general. They are responsible to the Court of Royal Audience for the discharge of their duty. The ecclesiastical tribunal is composed of the bishop and provisor, and takes cognizance of affairs connected with the church. The governor is vice-regal patron, an office which empowers him to check abuses. There is a naval tribunal presided over by the commandant of the marine. The consulado is established for the decision of all mercantile disputes.

Puerto Rico presents the singular appearance of white men working in the same fields and at the same labour as coloured men without being considered as degraded by it. This arises partly from the island having been a penal settlement, where the convicts were put to field labour, and partly from the price of labour being so low as not to afford remuneration for the risks of the slave-trade. The antipathy which exists in other colonies and in the United States of North America between the white and coloured races does not exist here.

The usual proportion between the white population and the slaves is reversed in Puerto Rico. The following table from the statistical returns made by the Board of Trade show the increase of the population of late years:—

	1802.	1812.	1820.	1827.	1830.	1836.
Whites	78,281	85 662	102,432	150,311	162,311	188,869
Free Mulattoes	55,164	63,983	86 269	95 430	100,430	101,275
Free Blacks	16,414	15 833	20,191	25,057	26,857	25,124
Slaves	13,333	17,536	21,730	31,874	34,240	41,818
	163,192	183,014	230,622	302,672	323,838	357,086

The inhabitants are classified by the census according to their nations, thus:—

Spaniards, Creole and Peninsular	300,600
French	1,474
English and North Americans	327
Danes	212
Dutch	485
Italians	273
Germans	62
Africans	15,728
	319,161

And according to their professions and trades,—

Labourers	143,311
Carpenters	909
Shopkeepers	939
Merchants	880
Shoemakers	680
Dealers	544
Masons	282
Tailors	200
Coopers	151
Smiths	124
Not distinguished	15,579
Having no trade or profession	155,562
Total	319,161

The proportion which the different races bear to each other is as follows:—Whites 50⅓, free people of colour and blacks 39¼, and slaves 10⅝ per cent.

The proportion of sexes is in favour of the females, excepting among the slaves:—Whites,—males 49⅓, females 50⅔; free coloured,—males 48½, females 51½; and slaves,—males 51⅓, females 48⅔. In the gross population, males 49, females 51.

The number of marriages in 1828,—

Whites.	Free coloured.	Slaves.	Total.
734	489	33	1256

In 1830 the number had increased to 2152, of which 150 were among slaves. Of births the total number is 4¾ per cent. per annum of the population, thus distributed:—

Whites	3¾ per cent.
Free coloured	5¼ "
Slaves	5¾ "

Giving 1 birth to every 26½ whites.
" " 17½ free coloured.
" " 17¾ slaves.

The deaths amount annually to 2¾ per cent. of the whole population:—

	Total.	Males.	Females.
Whites	2⅛	2⅓	1¾
Free coloured	3$\frac{1}{10}$	3	2¾
Slaves	3¾	3⅓	3¼

Giving 1 death to 40⅓ of the whites.
" " 31¾ of the free coloured.
" " 27 of the slaves.
" " 37 of the entire population.

The number of the slave population is probably increasing with the demand for labour consequent on the additional cultivation. An extensive system of kidnapping negroes from other islands, chiefly from the British Leeward Islands, has prevailed of late years, many of whom have been discovered in Puerto Rico. The daily allowance to a slave is seven or eight plantains, or an equivalent in yams or other roots, 8 ozs. of salt-fish, 4 ozs. of rice or peas; also three suits by the year, each consisting of a cotton shirt, trowsers, handkerchief, hat, or cap, and a woollen shirt or jacket. They work nine hours a day, except during the harvest, when they must work thirteen hours. Marriage is promoted among the slaves, and the master of the male or female is obliged, on their marriage, to sell his slave, at a price fixed by arbitration, to the owner of the other.

The annexed table shows the quantity of produce exported from the island of Puerto Rico in the year 1836:—

Sugar	1,198,888⅛	quintals.
Coffee	52,772½	quintals.
Hides	8,686	quintals.
Molasses	1,724,661	gallons.
Raw Cotton	19,522⅓	quintals.
Unmanufactured:—		
Tobacco	49,542	quintals.
Cigars	8,000	quintals.
Rum	359⅛	bocoyes.
Cattle	4,911	head.

The quintal is equal to 100 lbs. avoirdupois.

The fanega is equal to one-fifth of a quarter.

The arroba is equal to 4½ gallons, and contains 32 cuantillas.

Puerto Rico contains 14,435 houses in town and country, 29,696 huts and cottages, 1555 sugar estates, and 124 coffee estates.

Puerto Rico has no mines or manufactures, no indigenous quadrupeds, scarcely any birds except a few species of water-fowl and some parrots, and no monkeys. The canefields are infested by rats of a large size, which at times commit great ravages.

A royal decree was issued in the year 1815 for the promotion of the commerce and agriculture of Puerto Rico, from which time the commercial prosperity of the island has been rapidly advancing.

There are two classes of merchants: consignees of cargoes imported in European and American vessels, who receive a commission on the purchase and sale of merchandise; and those who with capital of their own purchase goods and retail them. There is scarcely such a person as a wholesale merchant in the island. No foreigner, unless naturalised, can make purchase or sale in his own name; five years' residence in the dominions of Spain entitles him to naturalization.

There is an ad valorem duty of 17 per cent. on the importation of foreign goods; the consequence of which is a contraband trade with St. Thomas's and other islands, of so great extent as to falsify considerably the tables of imports. The trade with America consists in salt-fish, flour, butter, grain, and lumber; with France, in linens, cambrics, ornaments, toys, and jewellery; with England, cotton goods, hardware, and earthenware: England takes a great quantity of cattle for the supply of her colonies; with Spain, olives and brandies, wines, dried fruits, anchovies, &c.; with the German States, in glass, sword-blades, linens, hams, &c.

The following is a statement of the total value of imports and exports, and amount of customs duties received in the island of Puerto Rico in each of the years 1835 and 1836:—

Years.	Value of Imports. Dollars.	Value of Exports. Dollars.	Total. Dollars.	Customs Duties, includ Tonnage.
1835	3,914,116	3,949,534	7,863,651	746,285
1836	4,005,944	4,099,576	8,105,521	800,025

The government returns state the rural and urban wealth of Puerto Rico to be 22,719,213 dollars, and the value of its agricultural produce 5,259,769 dollars, in the year 1834.

Statement of the number of vessels, distinguishing Spanish from foreign, which entered the ports of the island of Puerto Rico in 1835 and 1836·

Years.	Spanish.	Foreign.	Total.	Tonnage.
1835	750	504	1254	88,268
1836	707	521	1228	93,447

Statement of the number and tonnage of vessels, distinguishing the countries to which they belong, that entered and cleared at the island of Puerto Rico in the year 1836:

	Inwards.		Outwards.	
Countries.	Ships.	Tons.	Ships.	Tons.
Spanish	707	29,161	659	27,695
American	302	45,651	319	45,934
Danish .	49	4,273	49	4,174
Dutch .	13	701	13	701
Sardinian	8	1,058	8	1,058
Bremen .	11	1,048	11	2,160
French .	91	7,052	94	7,208
English .	37	2,772	35	2,658
Swedish .	7	216	7	216
Hamburg	3	541	3	541
Total .	1228	93,446	1198	92,285

Statement of the value of merchandise imported into and exported from the island of Puerto Rico, distinguishing the trade with each country:

Countries.	Imports. Value. Dollars.	Exports. Value. Dollars.
Spain . .	485,823	1,150,536
Spanish Colonies	1,848,405	413,252
United States .	1,121,900	1,876,720
Denmark .	339,394	161,556
Holland .	75,342	9,156
Sardinia .	50,245	79,204
Bremen .	43,577	107,521
France .	31,116	145,687
Great Britain .	5,084	65,353
Sweden .	4,208	3,568
Hamburg .	814	84,010
	4,005,908	4,099,572

(Flinter's *Present State of Puerto Rico*; Turnbull's *Travels in the West*; *Statistical Returns of the Board of Trade*, 1837.)

PUFF-BALL. [Lycoperdon.]

PUFF-BIRDS. [Barbets, vol. iii., p. 434; Kingfishers, vol. xiii., p. 227.]

PUFFENDORF, SAMUEL, an eminent historical and juridical writer, was born in the year 1632, at the small town of Chemnitz in Saxony, in the neighbourhood of which place his father was settled as a Lutheran clergyman. He received the earliest rudiments of his education at Grimma, one of the three schools called Prince's Schools, founded by the elector of Saxony, in 1550. Being designed by his father for the Protestant ministry, he was removed from Grimma to the university of Leipzig, where he studied theology for several years. Accident and the tendency of his mind led him while at Leipzig to change his course of study, and about the year 1656 he went to the university of Jena, where he devoted himself to the study of mathematics, under the tuition of Erhard Weigel, whose improvements in the method of teaching natural philosophy had at that time excited great attention in Germany. About the same time Puffendorf appears to have first applied himself to the law of nature, on which subject he afterwards became a distinguished writer.

About the time that he quitted Jena, his brother, who had been employed by the chancellor Oxenstiorn in lucrative and confidential offices under the Swedish government, advised him to seek his fortune in foreign diplomacy, and with a view to this ultimate object he obtained a situation as tutor to the son of the Swedish ambassador at Copenhagen. He had scarcely joined the legation when a rupture ensued between Denmark and Sweden, and the whole family and attendants of the ambassador were detained as prisoners during eight months at the Danish capital. Puffendorf employed the leisure which this captivity afforded him in investigating and arranging the principles of general law contained in the works of Grotius, Hobbes, and some other political writers. These he reduced to writing, adding to them such reflections and arguments as had occurred to his own mind. At the time of its composition this work was not intended for publication; but on visiting Holland shortly after his enlargement, he was induced by the advice of a friend to publish it; and it accordingly appeared at the Hague, in 1660, under the title of 'Elementa Jurisprudentiæ Universalis.' This work, though crabbed in style and greatly inferior in general merit to the treatise 'De Jure Naturæ et Gentium,' exhibited much closeness of thought, and contained some enlarged and original views upon the subject of jurisprudence; and the circumstance of its dedication to the elector-palatine Charles Louis, perhaps more than its substantial merits, made it the foundation of the subsequent fortunes of the author. The elector-palatine was desirous of attracting attention to the university of Heidelberg, which had fallen into decay; and as one of the means to this object, he founded a professorship of the law of nature and nations, and placed Puffendorf in the chair, entrusting him also in particular with the education of his son the electoral prince. Puffendorf commenced his occupation as professor at Heidelberg, in 1661, and the numerous auditory attracted by his lectures supplied him with pecuniary independence as well as encouragement to persevere in his juridical studies. Soon after his establishment at Heidelberg he directed his attention to the constitution of the body termed the Germanic empire; and struck with the absurdities and incongruities of this strange compound of princes, small republics, prelates, and knights, each of whom exercised within their respective territories a degree of sovereign authority, he composed a treatise exhibiting in rather strong colours the usurpations and defects of the system, and pointing out practical remedies for the grievous abuses which it had occasioned. As the existing order of things in Germany was criticised in this work with considerable freedom and severity, Puffendorf did not venture to publish it in his native country, or with his own name, but sent it to his brother Isaiah Puffendorf, who was at that time the Swedish ambassador in France, who, after showing it to Mezeray, directed it to be published at Geneva, under the title of 'Severini de Mozambano, De Statu Imperii Germanici.' This work excited very general attention in Europe, being translated into German, English, and French, and not only involved Puffendorf for several years in an active controversy with German civilians, but exposed him to the indignation of some of the more powerful constituents of the Germanic body, and especially of the Austrian government. To avoid the possible consequences of the commotion his work had occasioned, he gladly accepted, in 1670, an invitation from Charles XI. of Sweden to become professor of the law of nations at the university of Lunden, then recently founded. About two years after his removal to Lunden, he published the great work upon which his reputation at the present day is principally founded, entitled 'De Jure Naturæ et

Gentium.' It is a very careful and accurate digest of the law of nature, and being arranged on a much more scientific principle than the work of Grotius, 'De Jure Belli et Pacis,' is more useful to the student.

Grotius has inverted the natural order of treating the subject by considering at once the artificial states of peace and war and the law of nations, without first tracing the original principles of the science as they are found in human nature. Puffendorf, on the other hand, commences with the law of nature, then considers the subject as applied to the conduct of individuals, and lastly investigates the difficult and complicated questions which arise in the intercourse of nations. 'Without the genius of his master,' says Sir James Mackintosh, 'and with very inferior learning, Puffendorf has yet treated the subject with sound sense, with clear method, with extensive and accurate knowledge, and with a copiousness of detail, sometimes indeed tedious, but always instructive and satisfactory.' (*Discourse on the Study of the Law of Nature and Nations.*)

In consequence of some of the new views contained in this work, it was virulently assailed by contemporaries, and involved the author a second time in angry controversy; but, at the same time, it raised the reputation of Puffendorf to a great height throughout Europe; and a few years after its appearance, the king of Sweden removed him to Stockholm, making him his historiographer, and giving him the title of counsellor of state. In his official character he composed and published in Latin a 'History of Sweden, from the expedition of Gustavus Adolphus into Germany, until the death of Queen Christine;' but although a promising theme for an historian, Puffendorf has not availed himself of the rich materials which were placed at his disposal in the archives of the Swedish government in such a manner as to render his narrative attractive or complete. In 1688 the elector of Brandenburg, Frederic William, invited him to Berlin, with the consent of the king of Sweden, and employed him in writing the history of his life and reign. The elector also bestowed upon him the title of counsellor of state, with an annual pension of 2000 crowns. In obedience to this engagement, he wrote and published, in nineteen books, Commentarii de Rebus Gestis Frederici Willielmi Magni, Electoris Brandenburgici,' a work which neither experienced nor deserved greater success than his previous historical performances. His employment in Berlin was considered o be merely temporary, and he intended to return to Stockholm as soon as he had completed his engagement with the elector of Brandenburg; indeed the king of Sweden always ontinued his esteem for him, and a few years only before his death, and during his residence at Berlin, raised him to he dignity of a baron. He died however in Berlin, in October, 1694. A complete catalogue of the voluminous writings of Puffendorf, and an account of the various editions of each, will be found in a note to the article under his name in the 'General Dictionary,' and also in the 'Biographie Universelle.'

PUFFIN. [AUK, vol. iii., p. 99; PETRELS, vol. xviii., p. 41.]

PUG, a dwarf variety of the dog, somewhat resembling mastiff or bull-dog in miniature. The Dutch Pugs have more the aspect of the large varieties last named than the French Pugs, some of which latter are very small. Both re snappish and noisy, but capable of strong attachment to heir masters or mistresses. The French Pugs are docile, nd may be easily taught many amusing tricks.

PUGET, PIERRE, who has been called the Michael Angelo of France, from his ability in painting and archiecture, as well as in sculpture, and perhaps also on account of a kindred enthusiasm and decision of character, was orn, in 1622, at Marseille, where his father practised as an rchitect and sculptor. It was from him that he received his first instructions in art, after which he was placed under shipwright, or builder of galleys, to learn to carve the oraments used in such vessels. Disgusted with the drudgery of such workmanship, he set out for Italy, and passed a onsiderable time at Florence, where he pursued his studies as a sculptor with great success. He next repaired to Rome, whither he was attracted by the fame of Pietro de Cortona; and not only did he become the pupil of that rtist, but made such progress under him, that he accomanied him to Florence as his assistant in painting the eilings of the Pitti palace. Instead however of remaining here, he suddenly resolved upon returning to France, and he was then only twenty-one. On his arrival at Marseille he was very well received, and was shortly afterwards commissioned to design a vessel of extraordinary magnificence, named La Reine, in honour of Anne of Austria. That princess being desirous of obtaining accurate drawings of all the antient monuments at Rome, the person commissioned by her to procure them thought that he could not do better than take Puget with him for the purpose of executing them. Puget accordingly proceeded a second time to Rome, and there spent between five and six years; but what afterwards became of that valuable collection of drawings is not known.

On his second return from Italy he executed several works in painting; but his excessive application to that art so seriously affected his health, that he renounced the practice of it, and confined himself thenceforth to architecture and sculpture. His talents met with employment at Toulon and Marseille, for which latter city he projected many embellishments, which established his reputation as an architect; and he further gave proof of his skill in engineering by different ingenious machines and inventions which he introduced into the marine at Toulon.

He was sent by Fouquet to Genoa for the purpose of selecting marble for some of the works proposed to be executed at Marseille; but that minister being shortly afterwards disgraced, instead of returning home, Puget preferred remaining at Genoa, where he produced some of his most noted pieces of sculpture, the two statues of St. Sebastian and St. Ambrosius, and the grand bas-relief of the Assumption, in the chapel of the Albergo de' Poveri, besides various architectural ornaments. At length he was recalled by Colbert, who obtained for him a pension of twelve hundred crowns, in consequence, it is said, of the earnest recommendation of Bernini. That the patronage of the one and the recommendation of the other were not discredited, is proved by his two celebrated performances at Versailles, the Milo of Crotona, and the group of Perseus and Andromeda, the former of which is generally reckoned the chef-d'œuvre of his chisel, and a work that will bear comparison with the antique. He was not however to be attached to a court, even by the flattering compliments of Louis XIV. himself, but he retired to Marseille, where he built himself a small residence, which he occupied until his death, December 2nd, 1694, at the age of seventy-two.

Puget undoubtedly merited the applause that he received from his countrymen and contemporaries, but dispassionate criticism will not exactly confirm previous opinion. The historian of modern sculpture, Cicognara, speaks of Puget in rather a disparaging manner, insisting that though they manifest genius, his productions almost invariably betray inaccuracy as to proportions, want of refinement in taste, and show more of the painter than of the sculptor in their treatment, seldom producing a pleasing effect except from a single point of view. Neither the Milo nor the Perseus escapes reprehension from him; and he says that as a composition, the former has been frequently surpassed by young artists who have tried their powers on the same subject.

As an architect, he must at the present day be held even lower, if, as a sample of his taste in that art, we refer to the court-yard and old building of the British Museum, designed and erected by him, and in which it is easier to perceive a kind of dull stateliness than to detect the slightest element of beauty.

PU'GLIA, the antient *Apulia*, is the general name given to a large division of the kingdom of Naples, which lies east of the Apennines, and extends to the Adriatic Sea. It comprises the three administrative provinces of Capitanata, Terra di Bari, and Terra d'Otranto. In former times the kingdom of Naples was divided by geographers into four great divisions, called Abruzzi, Puglia, Calabria, and Terra di Lavoro, each of which was subdivided into three administrative provinces. Puglia is naturally divided into two regions, namely, the great plain of Capitanata, called Puglia Piana, or 'Flat Apulia,' and the hilly region of Bari and Otranto, called Puglia Pietrosa, or 'Stony Apulia.' A description of these two regions is given under CAPITANATA, BARI (TERRA DI), and OTRANTO (TERRA DI). The whole of Puglia is one of the most productive countries of the kingdom; its chief wealth consists in corn, oil, wool, and cattle. In antient times this tract of country was inhabited by the Dauni, the Appuli, the Peucetii, the Calabri or Messapians, and the Salentini. [APULIA.] The Calabri occupied the northern and the Salentini the southern coast of the Iapygian peninsula. The first Norman conquerors of Naples styled themselves dukes of Apulia and Calabria, before Naples had become the capital of the whole kingdom.

PU'LCI, LUI'GI, born at Florence, in 1431, of a respectable though poor family, became early in life acquainted with the wealthy family of Medici, through which he seems to have obtained an inferior office under the Florentine republic. He travelled about Italy, and even beyond its limits, according to his own statement. Few particulars of his life are known. He married Lucrezia Albizzi, by whom he had two sons, who survived him. He was a welcome guest at the table of Lorenzo de' Medici, who relished his wit and his extempore poetical effusions. Lucrezia Tornabuoni, Lorenzo's mother, urged Pulci to write an epic poem. Pulci undertook the task, and he looked for his theme among the traditional legends of Charlemagne and his Paladins, as recorded by Turpin, which had already become familiar in Italy through the Italian romance 'I Reali di Francia,' written in the thirteenth century, and had become a popular theme for the extempore effusion of strolling story-tellers. Pulci took for the subject of his poem the treachery of Gano of Maganza, one of Charlemagne's vassals, who is reported in the old legends to have conspired with the Saracens of Spain against his master, and to have brought about the fatal defeat of the French at Roncesvalles in the Pyrenees. Pulci was well acquainted not only with Turpin's 'Chronicle,' but with the old French and Provençal romances which related to the fabulous history of Charlemagne's Spanish wars. An abstract of these singular traditions, in which the confused records of the wars of Charles Martel and his son Pepin against the Saracens in France were mixed up with the short campaign of Charlemagne himself beyond the Pyrenees, is given (by Foscolo) in No. 42 of the 'Quarterly Review,' and also in an article on the early poetry of Spain, in No. 78 of the 'Edinburgh Review.' Pulci moulded those rude materials into a living form, and breathed into it his own poetical inspiration. His predecessors had dealt out the old traditional fables in a sober serious strain. Pulci was the first to seize the ludicrous side of the stories, and to derive from it a fresh subject for poetry and a source of amusement for his readers. Still his poem is not, as it has been by many supposed to be, a burlesque poem, but a combination of the serious with the facetious; it is a romance accompanied by its own parody. The poet is often evidently in earnest, being carried along by the lofty or pathetic events which he describes; but he now and then relaxes to enjoy a laugh with his hearers at the expense of his heroes, and of the popular story-tellers, who formed a numerous tribe in his age, and who, by their pompous diction and their exaggerations and anachronisms, enhanced the absurdity of their wondrous tales. One character however, that of Orlando, the French and Spanish Roland, Pulci preserved in its original simple grandeur, as handed down by old tradition. It was reserved for Bojardo to lower the original character of the Roland of old traditional legend, the chaste and unspotted champion of religion, loyalty, and chivalry, and to reduce it to that of a brave but frail warrior. Pulci brought also on the scene another worthy competitor for fame, Rinaldo of Montalbano, the Reynault of the French romances, whose character and adventures he took chiefly from 'Les Quatre Fils d'Aymon' of Adenès, an old romance writer of the thirteenth century.

The title of 'Morgante Maggiore,' which Pulci chose to give to his poem, is a capricious one, for the giant whom he introduces by the name of Morgante is only a subordinate character, and acts as squire to Orlando. The reason of the adjunct 'Maggiore' is not perceived, unless it was given to him on account of his great strength.

Orlando is the hero of the poem, but Gano may be considered as the principal actor; like Satan in Milton, he is the author of all mischief, and his punishment is properly the end of the action. '*The* Treasons of Gano' would have been a more appropriate title to the poem. Another giant, called Margutte, is the Thersites of the poem. He is an open scoffer at religion, and boasts of his numerous sins; he is, in short, an impudent but humorous villain. He accompanies Morgante, who is a pious personage, and dies at last of an immoderate fit of laughter at some ludicrous sight. This character of Margutte, which is merely episodical, and which seems to have been introduced by Pulci in a fit of unrestrained mirth, has been adduced by Voltaire and others as a proof of Pulci's unbelief. But the poet, from the beginning, proclaims Margutte to be what he is, a profligate despicable fellow, and by so doing shows no intention of recommending his opinions or example.

In canto xxv. there is a curious dialogue between Rinaldo and a familiar dæmon named Astaroth concerning the then so-called Pillars of Hercules. The dæmon says: 'An old and hallowed error has long prevailed, that no one can venture westward of this point without incurring certain death. Know then that this is a vain supposition, for it is possible to navigate far beyond, as the sea is level everywhere, although our world has a round form, as everything above is attracted to the centre, and the earth itself stands suspended among the stars. And ships shall proceed far beyond the boundaries which Hercules fixed here in times of ignorance, and they will discover another hemisphere, where are towns, nations, and empires. Those are the antipodes, and they adore the Sun and Jupiter and Mars, they have trees and cattle as you have, and often wage war against one another.' (Canto xxv., st. 228, et seq.) Pulci wrote this fifteen years at least before Columbus sailed on his memorable expedition. Rinaldo asks whether the antipodes are of Adam's race, and are capable of obtaining salvation. To this delicate question the dæmon answers, that all men may be saved by the Cross, and that the day will come when, after many errors and wanderings, all will acknowledge the truth and find acceptance. The whole passage is curious as illustrative of the state of mind among men of information in Italy in that age. Roland's last fight and dying scene at Roncesvalles are beautifully described by the poet. The farewell of Roland to his faithful steed, his trusty companion in many a battle, his confession and last prayer, and the angelic melody which is heard above, as he expired—all this part is equal in pathos and loftiness to any passage in either Dante or Tasso. The poet felt evidently interested in his subject and wrote in earnest. But even here he occasionally breaks out, in the midst of his most serious narrative, into a fit of comic humour, as *if* by way of relaxation. While the fearful conflict is raging in the glen of Roncesvalles, the poet descries two dæmons keeping watch in a deserted chapel on the outskirts of the defile, intent upon seizing and securing the souls of the Saracens who fell in the battle, as their lawful prey. The eagerness of these satanic sentries is described with much drollery.

It is a curious fact that the first edition of the poem of Pulci, with all its freedom of thought and expression, came out in 1481, from the press of the convent of Ripoli at Florence, and that some of the nuns, and one Marietta among them, acted as compositors, and were paid accordingly. (*Notizie Istoriche sopra la Stamperia di Ripoli*, by Father Vincenzo Fineschi, Domenicano, Florence, 1781.) There was a much greater degree of freedom in speaking and writing in Italy during the fourteenth and fifteenth centuries than there has been at any time since; the change took place about the middle of the sixteenth century, when the alarm about the spreading of the doctrines of the Reformation induced Pope Paul III. to establish permanently, with the consent of Charles V., the court of the Inquisition, which effectually silenced both tongues and pens.

The 'Morgante Maggiore' is less read and noticed now even in Italy than it deserves; the poem has many beauties, and great fluency and vivacity of diction, owing to the author being a Florentine and writing in his own vernacular language. Pulci may be considered both as the last of the old romancers and as the first of the Italian epic writers. His poem retains much of the simplicity and antique cast of the traditions of the dark ages, enriched with the information of a more enlightened period. By reading the 'Morgante' attentively, one is less surprised at some old Florentine critics giving it the preference over Ariosto's splendid and elaborate poem. But the two works are the representatives of two different ages, and there is the same difference between them as there was between Pulci's jovial and free-spoken friend, Lorenzo de' Medici, and the princes of the House of Este, the courtly patrons of Ariosto. The edition of the 'Morgante,' Naples, 1782, contains a good biography of the author.

Pulci wrote also a number of satirical and some licentious sonnets, and other light poetry, including his 'Confession,' the copies of which are rather scarce. Pulci died at Florence in 1487.

PULEX, the name given by Linnæus to a group of insects of which the common flea may be regarded as the type.

The fleas are considered by Latreille, Kirby, and many other entomologists, as constituting an order of insects. They form the group *Suctoria* of De Geer; the order *Siphonaptera* of Latreille, and *Aphaniptera* of Kirby and Spence, by whom they are placed between the orders *Diptera* and *Aptera*. In the 'Règne Animal,' they are arranged between the orders *Parasita* or *Anoplura* of Leach, and the *Coleoptera*. It is highly probable however that when this group is better known—when the numerous insects allied to the fleas are more common in our cabinets—it will be found that they do not constitute an order by themselves, but are aberrant forms of the other *well established* orders; in these there is a certain degree of uniformity, as regards numbers, variety of habits, &c., which can but lead us to doubt the validity of the so-called orders containing only one or two genera, and but few species, such as the present order, and the orders *Aptera*, *Hemaloptera*, and *Strepsiptera*. It is moreover worthy of observation that each of these so-called orders is composed of *parasitic insects*, which necessarily involves a structure very unlike the more typical species of the groups to which we may suppose they belong. Upon these grounds, the orders just mentioned, being regarded as not sufficiently worked out, are omitted in the article INSECTA.

The *Suctoria* have the mouth composed of three pieces, enclosed by two articulated laminæ, which, when united, form a cylindrical or conical proboscis, the base of which is protected by two scales. They undergo a complete metamorphosis: the larva is of an elongated cylindrical form, and when about to change into the pupa state, encloses itself in a silken cocoon, and at the end of a few days assumes the mago or perfect state.

In the genus *Pulex* the body is compressed, of an oval form, and protected by a tough coriaceous covering. The head is small and much compressed, and furnished on each side with a small round eye; behind this is a concavity in which the antennæ (which are three-pointed) are situated.

On the anterior part of the head are two four-jointed organs, supposed by Latreille to be the antennæ, but which must be palpi, the organs situated behind the eyes being now supposed to be the antennæ. The legs are large and strong, particularly the hinder pair, by which the insect jumps, and covered with spines; the tarsi are five-jointed, and the terminal joint is furnished with two elongated claws; the anterior pair of legs are inserted almost under the head, and the rostrum lies between them.

The female flea is said to lay about a dozen eggs, which are of a whitish colour and somewhat viscid: the larvæ are long and slender, and have no legs; the head is scaly and has no eyes, but is furnished with two very small antennæ: each of the segments of the body is provided with little tufts of hair, and the terminal segment has moreover two hooked appendages at its apex.

The common flea (*Pulex irritans*) is but too well known. It is said to attack dogs, cats, and other animals, as well as man; but there are other species which appear to be peculiar to certain birds and quadrupeds, and these have received in most cases the names of the species they attack, such as the dog flea (*Pulex Canis*), the mole flea (*P. Talpa*), that of the martins (*P. hirundinis*), and of the mouse (*P. musculi*), &c.

The Chigoe of the West Indies and South America also belongs to this group, being the *Pulex penetrans* of authors. 'It is described,' say Messrs. Kirby and Spence (vol. i., p. 102), 'as generally attacking the feet and legs, getting, without being felt, between the skin and the flesh, usually under the nails of the toes, where it nidificates and lays its eggs; and if timely attention be not paid to it, which, as it occasions no other uneasiness than itching (the sensation at first, I am assured, is rather pleasing than otherwise), is sometimes neglected, it multiplies to such a degree as to be attended by the most fatal consequences, often rendering amputation necessary, and sometimes causing death. The female slaves in the West Indies are frequently employed to extract these pests, which they do with uncommon dexterity.' Besides the name Chigoe, they are sometimes called *Jiggers*, *Nigua*, *Tungua*, *Pique*, &c.

For further information respecting this group of insects the reader is referred to M. Dugès's 'Recherches sur les Charactères Zoologiques du genre Pulex,' published in the *Annales des Sciences Naturelles* for October, 1832. Mr. Westwood has also published a paper 'On the Structure of the Antennæ of the order *Aphaniptera*,' &c., in the *Entomological Magazine*, vol. i., p. 359.

PULGAR, HERNANDO DEL, a celebrated Spanish historian, was probably born at Pulgar, a village close to Toledo, about 1436. When still young he entered the household of John II., king of Castile, and was educated as one of his pages. After the death of that monarch, Pulgar was appointed secretary to Henry IV., his son and successor, by whom he was entrusted with various confidential affairs. He retained his place on the accession of Isabella, who, in 1482, named him to the vacant office of national historiographer. From this period Pulgar remained near the royal person, accompanying the queen in her various progresses through the kingdom, as well as in her military expeditions into the Moorish territory. He was consequently an eye-witness of many of the warlike scenes which he describes, and from his situation at the court must have had access to the most ample and accredited sources of information. That portion of his Chronicle containing a retrospective survey of events previous to 1482, may be charged with gross inaccuracy: but this cannot be said of the remaining part, which may be received as perfectly authentic, and has all the character of impartiality. Pulgar's style of narration, though rather too prolix, is sufficiently perspicuous, and may be favourably contrasted with that of contemporary writers. His Chronicle was first printed at Valladolid, in 1565, when it appeared under the name of Antonio de Lebrixa, among whose papers it was found by his grandson the editor. Two years later (1567), another edition was published at Saragossa, with the real name of the author. The last and most elegant edition of Pulgar's Chronicle was printed at Valencia, in 1780, by Benito Montfort, in large folio.

Pulgar left some other works, of which his Commentary on the 'Coplas de Mingo Revulgo,' an antient satire, in the form of a dialogue between two shepherds, describing the court of John II., his 'Letters,' and his 'Claros Varones,' or sketches of illustrious men, have alone been published. The last contains forty-six biographical articles of the most distinguished individuals of the court of Henry IV., which, although too indiscriminately encomiastic, contain much valuable information on the principal actors of that period. Fourteen of the Letters were first printed at Seville, towards the close of the fifteenth century; the whole number—thirty-two—were afterwards printed at the same city, together with the 'Claros Varones,' 1500, 4to. Several editions of the same two works were subsequently published, Alcalá, 1524 and 1528; Zamora, 1543; Valladolid, 1545; Antwerp, 1632; all in 4to. The Letters only were afterwards translated into Latin by Julian Magon, and published with the Spanish text, at the end of Peter Martyr's 'Epistles,' Amstelodami, apud Elz., 1670. There are also three modern editions, Mad., 1747, 1775, and 1789, 4to. The two last are valuable on account of some excellent notes and their having a biographical account of Pulgar prefixed to them.

Nicolas Antonio (*Bib. Nov.*, vol. ii., p. 388), attributes to him a Chronicle of Henry IV., and a history of the Moorish kings of Granada. Other bibliographers have confounded this Pulgar with Hernan Perez del Pulgar, a distinguished officer, who gained great renown in the war of Granada, and who is supposed to be the author of a Chronicle of Gonzalo de Cordova, Alcalá, 1584, fol., as well as of a translation of a French historical work, entitled 'La Mer des Histoires,' which appeared at Valladolid, in 1512, fol., under the title of 'Mar de Historias.'

The year of Pulgar's death has not been ascertained: it is probable that he did not survive the capture of Granada by Ferdinand and Isabella, as his history falls somewhat short of that event, and we cannot suppose that he would have failed to commemorate the most important occurrence in the reign of his royal masters. Besides, from some remarks in his Letters, all of which were written after 1482, it would appear that he was already at that time much advanced in years. It is however quite clear that Pulgar was still living some years after 1486, the epoch which the 'Biographie Universelle' has erroneously assigned for his death. (Nicolas Antonio, *Bib. Nov.*, Vol. ii., p. 387.)

PULLEY. The pulley is one of the simple machines or mechanical powers employed in the construction of machinery and in the transmission and modification of force. The kinds of pulley in use are very numerous; but they all consist of combinations of a grooved wheel, moveable on an axis, and a rope lying in the groove; and the manner in which this rope passes over and under a system of these wheels, so as to connect the force with the resistance, or the power with the weight, determines the species or kind of pulley. But whatever the mechanical arrangement of the wheels and of the rope, the principle of all pulleys is the same, namely, the transmission of the tension of a rope, without sensible diminution, so as to obviate the loss of force consequent on rigidity. If a rope possessed perfect flexibility, any system of fixed points, as a series of nails, over which the rope might be bent, would answer the same end mechanically as a system of pulleys; but it is known that if a rope be bent over a sharp edge, little force will be transmitted beyond that point, as the daily experience of sustaining a very heavy weight attached to one end of a rope by a very small power at the other end, provided the rope be bent over several small edges, shows.

The principle of pulleys is the application of the theoretical principle of the transmission of the force of tension, and the following are the mechanical combinations by which it is usually put in practice:—

The single fixed pulley is a wheel with a groove on its circumference, and fixed in a case or *sheave* (as it is technically termed) to prevent the rope slipping from off its surface as it is moved round by the friction of the rope. The force is not modified in amount by this machine, but only in direction; that is, the power and the weight equal each other.

The single moveable pulley consists of one wheel fixed and the other moveable; the power acts at one end of the rope, and the other end is fixed to an immoveable obstacle; the weight or resistance is attached to the sheave of the moveable wheel. In this the power is one half the resistance when there is equilibrium. The pulley is sometimes called a *runner* by practical men.

The Spanish barton consists of two moveable wheels and one fixed wheel; and there are other arrangements, by which two fixed wheels and one moveable wheel are employed.

The first system of pulleys consists of an upper and lower set of wheels, called the upper and lower block; the upper being fixed, and the lower, to which the resistance or weight is attached, being moveable. The power is to the weight or resistance as unity to the number of wheels in the lower block.

Smeaton's tack, so called after the celebrated engineer of that name, contains two tiers of wheels, one above the other, in each block. The course of the rope is so arranged that the power and the weight act over the centre of the upper and lower block, and there is consequently no tendency in the system to twist, but the upper and lower block each preserves its horizontal position. This highly ingenious arrangement is open however to other serious objections, as great friction and unequal wear for the different velocities with which the wheels move. These practical difficulties are in a great measure obviated in the following system.

White's Pulley. The wheels in each block, the upper and lower block, turn on the same axis, and have different diameters, and are so proportioned that the circumferences have a velocity equal to that of the rope which passes over them. It is found on calculation that the several wheels in the upper block will revolve in the same time, if their circumferences are as the numbers 1, 3, 5, &c., and that the several wheels in the lower block will revolve in the same time, if their circumferences are as 2, 4, 6, &c. The diameters of the wheels consequently have this proportion. The lateral friction, however, of a number of independent wheels is great; and this is obviated by having the upper and lower block cut in grooves according to the above rule, so that all the friction is reduced to that of the pivots and the lateral friction of one wheel.

Second system. In the combinations previously described only one rope is employed, and the upper block is fixed and the lower block moveable. But in this system there are several ropes; the upper block consists of a single wheel, which is fixed, and the lower block of several moveable pulleys; the string of each being attached to the sheave of the moveable pulley above it, and to an immoveable obstacle. Each additional rope or moveable pulley in this system doubles the effect of the power, but it is not a system of any practical use.

Third system. In this the wheels of the upper block are moveable pulleys, with the exception of the upper wheel, which is fixed, and there are several strings, each attached to the weight. This is the most powerful system in respect of the ratio of the power and weight, but useless in practice.

The various systems of pulleys present the best practical illustration of the great mechanical principle of virtual velocities [Virtual Velocity], or, as it is expressed by practical men, that whatever is gained in force is lost in velocity. The power of a weight or of an agent in practical mechanics is estimated by the product of the force exerted and of the space through which it is exerted; in all the preceding systems it will be found that the product of the power and of the space through which it has moved is equal to the product of the weight and of the space through which it has moved; and the principle of virtual velocities may be easily verified.

PULMOBRANCHIATA, M. de Blainville's name for his first order of his second subclass (*Paracephalophora Monoica*) of his *Malacozoa*, and thus defined by him:—

Organs of respiration retiform or aërian, carpeting the *plafond* of the cavity situated obliquely from left to right upon the origin of the back of the animal, and communicating with the ambient fluid by a rounded orifice, pierced on the right side of the swollen border of the mantle. All these animals, according to M. de Blainville, are more or less disposed to breathe air. The greater part are terrestrial, some live on the banks of fresh waters and sometimes on the sea-banks. None of them bury themselves in the mud or sand of the bottom, excepting the *Limnacea*, during the rigorous season. All are phytiphagous, and are known in almost all parts of the earth.

The following families and genera are arranged by M. de Blainville under this order:—

Fam. 1. Limnacea.

Genera:—*Limnæa, Physa, Planorbis.*

Fam. 2. Auriculacea.

Genera:—*Pedipes, Auricula, Pyramidella.*

Fam. 6. Limacinea.

Genera:—*Succinea, Bulimus, Achatina, Clausilia, Pupa, Tomogeres, Helix, Helicolimax, Testacella, Parmacella, Limacella, Limax, Onchidium.*

Cuvier had previously named his first order of Gastropods *Pulmonés*, describing them as distinguished from other mollusks by their breathing the elastic air through a hole under the border of their mantle, and which they dilate or contract at their pleasure. They have, he adds, no branchiæ, but only a network of pulmonary vessels which creep upon the walls, and principally upon the *plafond* of their respiratory cavity.

Some, he observes, are terrestrial. Others live in the water, but are obliged to come from time to time to the surface, in order to open their pectoral cavity for respiration. He divides them into the following sections:—

1. Pulmonés Terrestres.

(Almost all four tentacles.)

Genera:—*Limax, Vaginulus, Testacella Parmacella, Helix, Vitrina* (*Helicolimax*, Fér.), *Bulimus, Pupa, Chondrus, Succinea, Clausilia, Achatina.*

2. Pulmonés Aquatiques.

(Two tentacles only.)

These, according to Cuvier, always come to the surface of the water to respire, so that they cannot inhabit deep waters: they live for the most part in fresh waters or salt lakes, or at least near the coasts and mouths of rivers.

Genera:—*Onchidium* (without a shell), *Planorbis, Limnæa, Physa, Scarabus, Auricula, Melampus* (*Conovulus*, Lam.).

Most of these forms have been treated of in this work.

PULMO'GRADA. The genus *Medusa* of Linnæus was placed by him in the second section of his *Vermes*, viz. *Mollusca*. The *Mollusca* were divided into six sections in the 'Systema Naturæ;' and in the last of these, consisting of those molluscous forms which had a central mouth below *Medusa* stood as the first genus, followed by *Asterias* and *Echinus*. The third section of *Vermes* (*Testacea*), with *Chiton* at its head, immediately followed. In this arrangement *Medusa* came between *Nereis* and *Asterias*; but in the body of the work it stands between *Sepia* and *Asterias*.

The following is the Linnean definition of the genus *Medusa*:—

Body gelatinous, orbiculate, depressed. *Mouth* beneath, central.

The genus contained twelve species, and these consisted not only of true *Medusæ*, but of *Cirrhigrada*, as *Porpita* and *Velella*. [Cirrhigrada.]

The *Acalephæ* of Cuvier (his third class of *Zoophytes*) comprehend, to use his own terms, Zoophytes which swim in the sea, and in whose organization may be perceived vessels which in truth are most frequently nothing but productions of the intestines hollowed in the parenchyma of the body.

Cuvier's first order of these *Acalephans*, or *Sea-nettles*, consists of the *Simple Acalephans*, which he characterises as floating and swimming in the sea by means of the contractions and dilatations of their body, their substance being gelatinous, without apparent fibres. The sort of vessels which are seen in some are hollowed in the gelatinous substance; they often visibly come from the stomach, and do not give place to a true circulation.

The genera contained in this order are the great genus *Medusa*, Linn., with its subgenera *Porpita* and *Velella*.

The great genus *Medusa* is characterised as having a disk more or less convex above, similar to that of a mushroom, and called the *umbrella*. Its contractions and dilatations concur to the motility of the animal. The edges of this umbrella, as well as the mouth, or the suckers, more or less prolonged into pedicles which take its place, in the middle of the lower surface, are furnished with tentacles of very different form and size. These different degrees of complication have given rise to very numerous divisions. For these we refer the reader to the 'Règne Animal.'

The *Arachnodermata* form the second class of M. de Blainville's *Actinozoaria*. He observes that this class corresponds exactly to the genus *Medusa* of Linnæus.

The following is M. de Blainville's definition of this genus:—

Body free, regularly oval or circular, subgelatinous, covered with an extremely fine skin, which is but little or not at all distinct, sustained or not by a solid subcartilaginous part, and provided with very diversiform radiated appendages.

Intestinal canal limited to the stomach and provided with a single orifice.

Ovaries multiplied, radiated, and opening in the interior of the stomach.

M. de Blainville goes on to state that their form, which is regular, is nearly always circular (the *Velellæ* alone being oval); sometimes discoid or spheroidal, but most frequently hemispherical, which causes them to resemble our umbrellas, and has given rise to the distinction of their body by that name. This body is sometimes furnished in addition in its circumference with more or less long cirrhi, to which the name of tentacles, or better, of tentaculiform cirrhi, has been given.

The lower surface of the umbrella, he observes, is sometimes entirely naked, but in other cases is provided with numerous and dispersed tentaculiform suckers, as in the *Porpitæ* and *Velellæ*, or else with very diversiform appendages, capillaceous at least at their extremity, which zoologists have termed arms, whence the denomination of *Brachideous* which they have given to some species. These appendages or arms are sometimes free from their base, but in other cases are united, which unity produces a sort of peduncle, which has originated the designation of *Pedunculated* for those species that are so provided. In the middle of the lower surface of the umbrella of these *Medusæ* is sometimes a species of peduncle, formed by a proboscidiform prolongation of the buccal orifice, and they are then called *Proboscideous*; but in the greater number of cases, the middle of the lower part of the umbrella is occupied by a more or less considerable mass, attaching itself to the body by four roots, in the form of a cross, so as to divide the buccal orifice into four semilunar parts. This peduncle, terminated by more or less numerous capillaceous divisions, has caused the name of *Pedunculated* or *Polystomatous* to be applied to those *Medusæ* which are provided with it.

The *Arachnodermata*, according to the same author, are all marine animals. They are found in all seas, often in considerable masses, but especially in the seas of warm climates, sometimes, it is said, in sufficient quantity to stop the progress of vessels which traverse the enormous shoals which they form. Although they are all free in the fluid, where they live at various depths, they are constantly in a reversed position, like the *Echini*. Their locomotive power is far from being sufficient to resist the currents of the medium which they inhabit; it consists of an isochronous movement of systole and diastole, which is continued, without suspension, to the termination of life, and in a more voluntary contraction of the borders of the umbrella.

M. de Blainville further states that he would willingly suppose that these animals are not born with the same degree of development which they afterwards attain, but he adds that he has no positive fact which supports this hypothesis. Pallas however, he observes, says that *Rhizostoma Cuvieri*, so common on our coasts, has much less complicated appendages in its youth. (See p. 121.)

M. de Blainville acknowledges that he knows nothing positive of the duration of life of these animals; he only knows that certain *Rhizostomata* acquire a considerable development, so as to reach nearly a foot and a half in diameter, and a total length of two feet at least; but, he adds, it would seem that the number of species which are nearly microscopic is infinitely the greatest; and he refers to Scoresby, who in his observations on the zoology of the arctic regions has furnished curious details on this subject.

The first subdivision of the *Arachnodermata* established by M. de Blainville depends on the existence or absence of a solid piece for the support of the umbrella or body of the animal, and consists of the *Cirrhigrada*, which are provided with that support, and of the *Pulmograda*, which are without any such support. These orders, observes M. de Blainville, are further distinguished by the very different nature of the appendages with which the umbrella is furnished on the buccal surface.

Of the *Cirrhigrada* we have already treated [CIRRHIGRADA]; we now have to turn our attention to the much more considerable order of the *Pulmograda*, or *Medusarians*.

ORGANIZATION.

The difficulty of examining the *Pulmograda* is, from the very nature of their texture, considerable, and that of preserving them in spirit great. It is not then to be wondered at that a great portion of their organization remained for a long time in obscurity, and that much relating to it still remains to be cleared up. To observe them with anything like a satisfactory result, they must be studied on the spot, and while they are alive; and thus it is that several points relative to their organization and habits, and their generation especially, have lately been cleared up. The possibility of fairly preserving them in spirit is shown in the museum of the Royal College of Surgeons in London, where, in the department comprehending the first division of the Preparations of Nat. Hist., in spirit, several of the Acalephans (No. 64 to 73 A, both inclusive) are to be seen so preserved. Of the *Pulmograda*, or *Medusarians*, there are eight specimens (No. 68 to No. 73 A, both inclusive).

The disk presents a uniform cellular appearance internally, and the cellular substance is very soft. In its mass no fibre has hitherto, we believe, been traced, and indeed the quantity of solid matter in the whole animal must be very small. Those who have taken *Medusæ* out of the sea and laid them upon a dry board or dry stone must have observed how soon they sink into a sort of deliquescence. Spallanzani came to the conclusion that the sea-water penetrating the organic texture constitutes the greater part of the volume in the *Medusæ*, some of which when newly taken out of the sea weighed 50 ounces, though their dried remains gave a weight of little more than 5 or 6 grains. A fine muscular membrane appearing, when examined with a magnifying glass, to be composed of numerous fleshy fibres disposed in small bundles radiating as regards the axis of the *Medusa*, and adhering closely to the gelatinous substance of the disk, may be seen in some species stretching over a given extent of the lower surface of the umbrella a little within its outer margin. Portions of the disk, or umbrella, have been cut from these animals whilst they were alive: those portions which had no part of this muscular membrane attached to them exhibited no signs of motion; in those, on the other hand, whose connection with the muscular membrane was preserved, the reciprocal contraction and dilatation were continued for some time. Those *Pulmograda* which have cilia around their margins have also circular vessels running along their bases, and most of the projectile and extensile tentacles and filaments have sacs and canals with contained fluids at their roots. If those cilia may be regarded, and they doubtless may be, as one of the causes, and a principal one, of locomotion, the pensile tentacles of the *Medusæ* may be viewed as ancillary at least to that faculty, though they probably are principally employed as nutrient organs. They are hollow and simple, and appear to increase in their extensibility in proportion to their connection with the appendages of the digestive cavities, or when furnished with a vesicle at their base. Suckers are found at the extremities and along the sides of these tentacles in several of the genera, so as to enable them more securely to catch the floating destined prey, or to assist in anchoring the Medusa when it would rest, as we have reason to believe it occasionally does. Eschscholtz was convinced that what Péron took for internal air-bladders were only appendages to the gastric cavities, into which air had been introduced by accident upon removing the animals from the sea.

Nervous System and Senses.—We are not aware of any quite satisfactory demonstration of a nervous system in the Acalephans. Dr. Grant indeed (*Zool. Trans.*, vol. i.) notices a structure in *Cydippe* which in his opinion can only belong to that system; but Eschscholtz, whose labours in investigating the organization of this class were not small, failed to discover nerves in the largest which he examined. That they enjoy ***sight*** has been a question. Ehrenberg has endeavoured to show that *Medusa aurita* possesses eyes in the form of small red points visible on the surface of the eight brown masses which are round the circumference of the umbrella; and he has compared these so-called eyes to those of certain *Rotifera* and *Entomostraca*. He considers the glandular body at the base of the pedicle to be an optic ganglion, and notices its connection with two filaments that decussate about the middle of their course; and he views these as constituting part of a nervous circle situated, for the greater part of its extent, directly along the bases of the row of tentacles surrounding the umbrella, and so forming a sort of outer wall of the circular vessel or appendage of the intestinal cavity which runs round the margin of the umbrella. He also describes another nervous circle, formed of four ganglion-like masses. These he states to be disposed round the mouth, and to be each connected with a corresponding group of tentacles.

But the general opinion seems to be that *touch* is the only sense possessed by the Acalephans, as far as proof has hitherto gone. That they are sensible to light, though the evidence in favour of their possessing sight properly so called may not be deemed conclusive, will be generally admitted. It is said that some of the smaller tribes have been known to shun a bright light, and to sink into deep water to avoid it. We remember to have seen off Seaton in a calm a shoal of the great Rhizostoma of our coasts swimming high with the tide: as they neared our boat, over whose side we were looking, they gradually sank in the clear glassy sea; and it required some dexterity to catch even one or two of the great numbers that passed with the boat-hook, the only engine we had for their capture. The least motion seemed to alarm them. We have observed a similar care in avoiding strange objects, when watching the shoals of smaller species of *Medusæ* coming up with the tide in the river Hamble in Hampshire, which is also very clear on the flood-tide when the rains have not been heavy.

The chief seat of the touch appears to be in the tentacul and cirrhi with which the majority of Pulmograda are furnished. Many of them, as we have ourselves observed make no sign when wounded extensively in the umbrella or disk. That their irritability is not small, is however shown by the experiments of Spallanzani, who, by friction of the muscular membrane of the umbrella and pricking it, excited the contracting and dilating motions in *Medusæ* which had been deposited in a dry place for four and twenty hours, had entirely ceased to exert their ordinary movements, and had lost two-thirds of their bulk or nearly so by the draining out of their contained fluids.

Food and Digestion.—The food, small fishes and marine animals, both living and dead, is probably conveyed to the mouth not only by the tentacles and cirrhi with which the greater part of the *Medusæ* are furnished, but also by contractions in the umbrella or disk itself. This must, one should think, be the case in those genera, *Eudora* for instance, which are without tentacles. The mode of taking the prey does not however seem to be accurately known. Botta's observations were confined to the digestion of a small fish by a *Medusa*, but he did not see the *Medusa* catch it. Fishes of some size have been found dead and entangled in the tentacles of *Medusæ*, killed most probably by that benumbing or stinging quality which has obtained for them the name of *Sea-Nettles*.

By the investigations of M. Milne Edwards principally, we now know that all the *Pulmograda* have gastric cavities, but all have not mouths in the ordinary acceptation of the word. In *Rhizostoma*, for instance, the only communication between the stomach and the outer surface is carried on through numerous branching canals in the pensile arms. The orifices by which these open externally are very minute; so small indeed, even where the species is large, as barely to admit *Entomostraca* of a very small size. In *Charybdæa*, which was believed to be agastric, M. Milne Edwards has shown that a mouth and an internal cavity with which that mouth is connected actually exist. The projection of extremely delicate tissues hanging from the roof, so to speak, of the funnel-shaped cavity of *Charybdæa* surrounded a central mouth and a stomach, from which proceeded four long canals leading to the tapering filaments pendent from the margin of the animal's body, and these canals he believes to bear analogy to the radiating vessels in Rhizostoma. There is a group of small cylindrical sacs at the beginning of each canal and opening into it, which, he thinks, may be regarded as biliary organs. The experiments of Spallanzani, which were principally made on *Aurelia phosphorea*, Lam. (*Pelagia*, Esch.), showed him four groups of convoluted membranous tubes, which resembled in structure the intestines of the *Vertebrata*, and though he did not trace their connections, he seems to have viewed them as true parts of the alimentary canal. They exhibited a peristaltic motion both when in the water and out of it, and this motion could be increased by stimulus. Professor Owen suggests that these must have been the ciliated and plicated tube-like *testes*, or *ovaria*, according to the sex of the individuals examined.

A good deal of obscurity still hangs over the *Respiration* and *Circulation* of the *Pulmograda;* but we cannot forbear to call attention to two most striking and beautiful examples of the anatomical skill of John Hunter, which may help the observer in his inquiry as to how these animals breathe. In the *Physiological Series of Comparative Anatomy* in the museum, the foundation of which was laid by him, will be found the following preparations (*Series I. Aeration of the blood by means of gills*):—No. 982. A Medusa (*Rhizostoma cærulea*, Cuv.) injected, with a portion of the disk removed so as to expose the central cavity or stomach, and the common orifice by which the numerous nutritive canals of the ramified processes pour their contents into that cavity. The vessels which proceed from it to ramify and subdivide, so as to form the respiratory network in the margin of the disk, are successfully injected. No. 983 shows a portion of the margin of the same specimen. The colour of the vermilion, which some chemical change has destroyed in the preceding preparation, is here preserved. The vascular network is seen to be formed by the lateral ramifications of straight vessels diverging to the circumference of the disk, and placed about an inch apart from each other. The vessels at the central margin of the network are the largest, and encroach in a semicircular form upon the intervals of the straight vessels, before these begin to distribute their lateral branches. The peripheral or terminal vessel of the network is very minute, and follows the scolloped contour of the margin of the disk. The whole of this vascular network is placed on the surface of the disk, which, in the natural position of the animal, rests upon the water; and thus this simple but beautiful respiratory apparatus is most effectually brought in contact with that element, through the medium of which the circulating fluids of the Medusa are submitted to the influence of the atmosphere. (*Cat. Mus. Coll. Chir.*, vol. ii.)

Till lately nothing comparatively was known of the *Generation* of this curious tribe. Gaede, Müller, Eschscholtz, Milne Edwards, Ehrenberg, Jæger, Siebold, and Wagner have all thrown light upon the subject, but the last has satisfactorily proved that some of the *Pulmograda* at least are diœcious; that they are in fact male and female; and that the organs of the male are in August crowded with *spermatozoa* aggregated in minute spiriform groups. No copulation has been observed, and the probability is that the male influence is conveyed by dispersion through the ambient medium. The *ova* are excluded by compression of the sac, and Siebold has traced their stages with as great exactness as has been employed in tracing those of any other animal. Not the least curious part of the generative system and economy of the Pulmogrades is the marsupial apparatus in certain species, as the *Medusa* (*Cyanæa*) *aurita*. This consists of a series of small flask-shaped processes developed from each side of the oral tentacles, where the ovaria are crowded with the impregnated ova, and by a transition, of which the nature is as yet as problematical as the passage of the embryo into the pouch of the Marsupialia, the ciliated ova, or gemmules, of the Medusa are transferred from the ovaria to the brachial marsupial sacs, and there undergo their development. The young Medusæ quit the marsupial pouches in the form of certain ciliated Infusoria, and afterwards assume the form of an eight-armed Polype, before their final metamorphosis, which would seem to take place in the month of February or early in March. The marsupial sacs are deciduous, and disappear soon after the escape of the young.

In the preparation No. 2235, in the Museum of the Royal College of Surgeons, is shown a Medusa (*Cyanæa aurita*, Cuv.). The four circular opaque white bodies in the substance of the disk, and seen in the interspaces of the oral tentacula, are the *gemmaria*, or organs in which the reproductive ciliated gemmules are developed: each gemmary opens by a separate ciliated orifice in the ventral or inferior surface of the body. (*Cat. Mus. Coll. Chir.*, vol. iv.)

Some idea of the swarms of *Medusæ* which are occasionally met with may be formed from the note appended to the account of the small luminous *Medusæ* brought from the Red Sea, and preserved in the Museum of the College of Surgeons (*Preparations of Nat. Hist. in Spirit*), No. 73 A. Henry Salt, Esq., was the donor, in 1811, and the note states that they were in such profusion, that the proportion of *Medusæ* to the water was fully one-third, perhaps nearly one-half. They were luminous only when alive.

ARRANGEMENT.

From the causes above noticed, when observing on the difficulty of satisfactorily examining and preserving the *Pulmograda*, the distinction of species becomes no easy task; and there is yet another reason, namely, the probability that in most of them the young after its exclusion from the ovarial sac undergoes a series of metamorphoses before it attains its full development, as it certainly does in some.

The names of Péron and Lesueur stand prominent as those of zoologists who have grappled with this obscure branch of natural history; but, as Cuvier observes, in their 'Prodromus' genera often occur which they have established on the authority of the bad figures of inaccurate authors, such as Baster and Borlase, and without having themselves seen the subjects; and from the same cause they have beyond measure multiplied the species. Still their arrangement should be that principally consulted by the student.

The method of Eschscholtz, who paid attention to a consideration hitherto comparatively disregarded, namely, the ramifications of the digestive canal, contains several new genera, which are disposed in a manner entirely different from the arrangement of Péron and Lesueur. The following table will exhibit his systematic distribution of the *Medusæ*:—

DISCOPHORÆ.
Section I.
Phanerocarpæ.
(Ovaries visible.)
Family 1.
Rhizostomidæ.

Genera: *Cassiopea, Rhizostoma, Cephæa.*

Family 2.
Medusidæ.

Genera: *Sthenonia, Medusa, Cyanæa Pelagia, Chrysaora, Ephyra.*

Section II.
Cryptocarpæ.
(Ovaries concealed.)
Family 3.
Geryonidæ.

Genera: *Geryonia, Dianæa, Linuche, Saphenia, Eirene, Lymnorea.*

Family 4.
Oceanidæ.

Genera: *Oceania, Callirhöe, Thaumantias, Tima, Cytacis, Melicerta, Phorcynia.*

Family 5.
Æquoridæ.

Genera: *Æquorea, Mesonema, Ægina, Cunina, Eurybia, Polixena.*

Family 6.
Berenicidæ.

Genera: *Eudora, Berenice.*

From these two systems, or at least by intercalating among the genera of Péron and Lesueur, the existence of which he is far from guaranteeing, those of Eschscholtz, M. de Blainville presents the following synoptic table:—

PULMOGRADA, OF MEDUSARIA.
Section I.
Simple.

Genera: *Eudora, Ephyra, Phorcynia, Eulymene, Charybdæa.*

Section II.
Tentaculated.

Genera: *Berenice, Æquorea, Mesonema, Polixena, Ægina, Cunina, Foveolia, Eurybia, Pegasia, Obelia.*

Section III.
Subproboscidean.

Genera: *Oceania, Aglaura, Melicerte, Cytacis, Thaumantias, Tima, Campanella.*

Section IV.
Proboscidean.

Genera: *Orithyia, Geryonia, Saphenia, Dianæa, Linuche, Favonia, Lymnorea, Sthenonia.*

Section V.
Brachideous and *Pedunculated.*

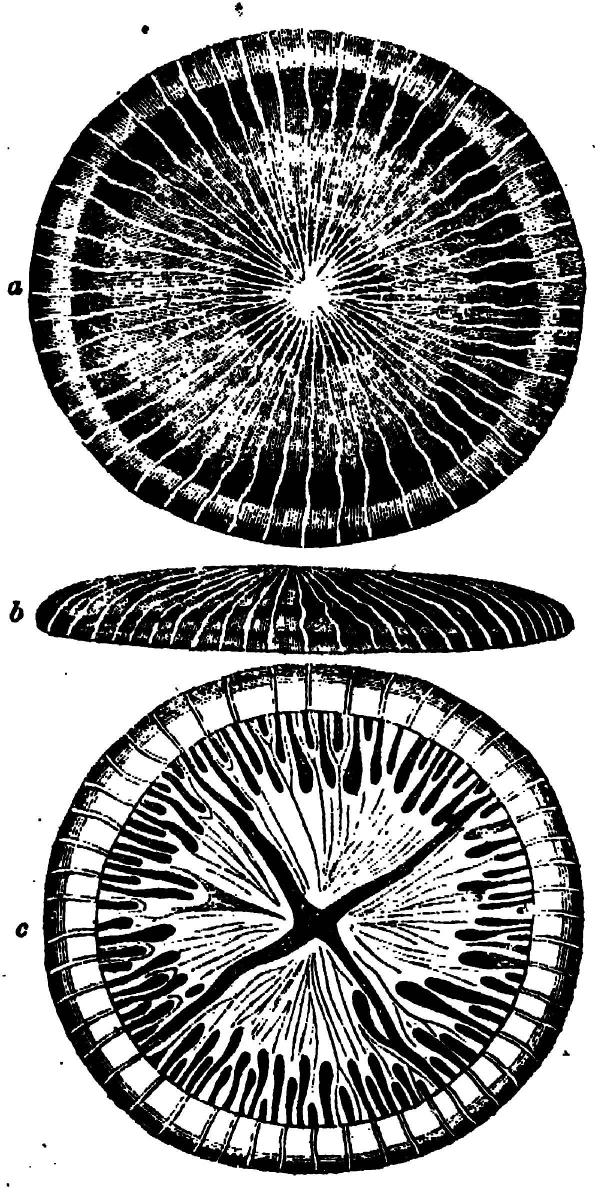
Genera: *Ocyröe, Cassiopea, Aurelia, Melitæa, Evagora, Cephæa, Rhizostoma, Chrysaora, Pelagia.*

We now proceed to lay before the reader examples of these several sections.

Section I.
Eudora.

Generic Character.—Body very much depressed, discoïd, simple, without tentacular cirrhi, without either peduncles or appendages, and offering within only ramified canals opening (s'abouchant) by four large trunks, in the form of a cross, into a small central cavity without external aperture.

Example, *Eudora undulosa* (Pér. and Les.).



Eudora undulosa.

a, view of the upper side; *b*, in profile, or with the edge of its disk towards the spectator; *c*, view of the lower side.

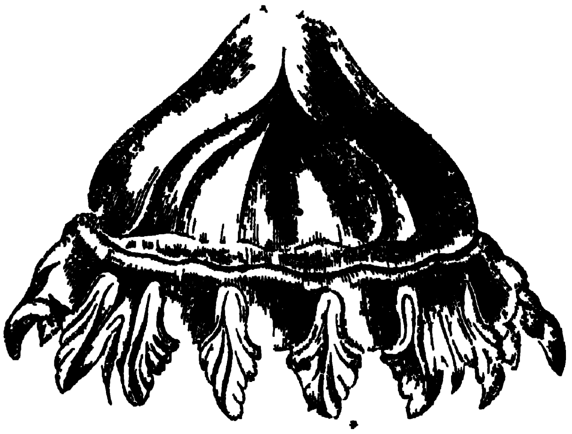
M. de Blainville remarks that he only knows this genus from the characteristic and short description given by Péron and Lesueur. He doubts whether this *Medusa* has not a mouth, for he thinks that the centre of the reunion of the four large trunks of the canals ought to be regarded as a stomach. He further inquires whether the individual figured was complete. He says that M. Lesueur informed him that there was a membrane on the lower surface, and he inquires whether this was not perhaps some remains of the stomachal cavity.

Cuvier united this genus with the *Geryoniæ*. Eschscholtz places it, as we have seen, in his family *Berenicidæ*, and unites *Euryale* with it.

Charybdæa.

Generic Character.—Body hemispherical, subconical, or even semi-elliptical, furnished on its circumference with foliaceous subtentacular lobes, hollowed below by a great stomachal excavation with an aperture as large as itself.

Example, *Charybdæa periphylla* (Pér. and Les.)



Charybdæa periphylla.

Section II.

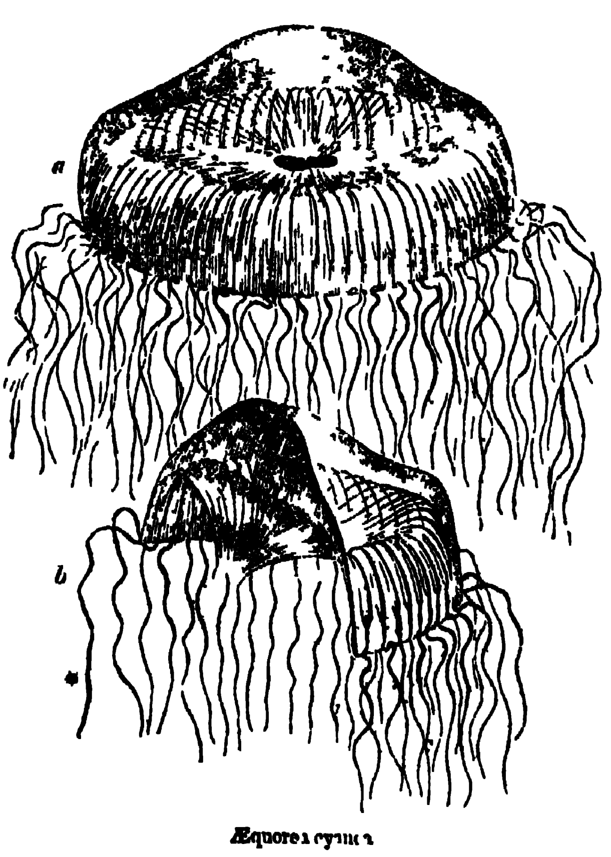
Æquorea.

Generic Character.—*Body* slightly discsiform, furnished at its circumference with a circle of filamentous tentacular cirrhi, often very long, and more or less numerous, a good deal excavated below, with a median orifice, often at the extremity of a sort of circular lip, which is more or less projecting or provided with tentacular fringes.

Stomachal appendages linear, numerous, or sacciform and not numerous.

Example, *Æquorea cyanea* (Pér. and Les.)

Habitat.—South Seas.



Æquorea cyanea.

a, the animal complete; *b*, a portion thereof.

M. de Blainville divides this genus into the following sections:—

*

Marginal cirrhi very numerous, stomachal appendages equally numerous and linear.

A. Lip simple.

Genus Æquorea.

B.

Lip fringed.

Genus Mesonema. (Esch.)

**

Marginal cirrhi as well as the stomachal appendages sufficiently numerous, or not numerous.

C.

Cirrhi sufficiently numerous, originating opposite to the triangular stomachal appendages.

Genus Polyxena. (Esch.)

D.

Cirrhi and sacciform stomachal appendages few.

Genus Ægina. (Esch.)

We have selected a genus of the first subdivision for illustration.

Section III.

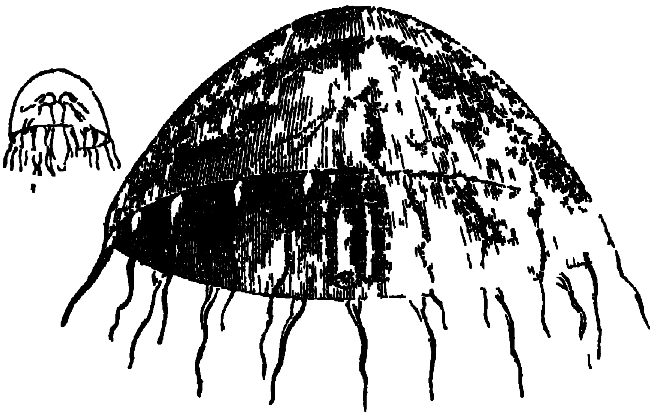
Thaumantias.

Generic Character.—*Body* hemispherical, provided at its circumference with tentaculiform cirrhi which are bulbous at the root; very much excavated beneath, and having in its middle a free pedunculiform stomachal cavity dividing itself into claviform canals and terminated by a simple buccal orifice.

Example, *Thaumantias cymbaloidea* (*Med. cym.* Slabber; *Dianæa cymb.*, Lam.)

Placed by Péron among his *Oceaniæ*.

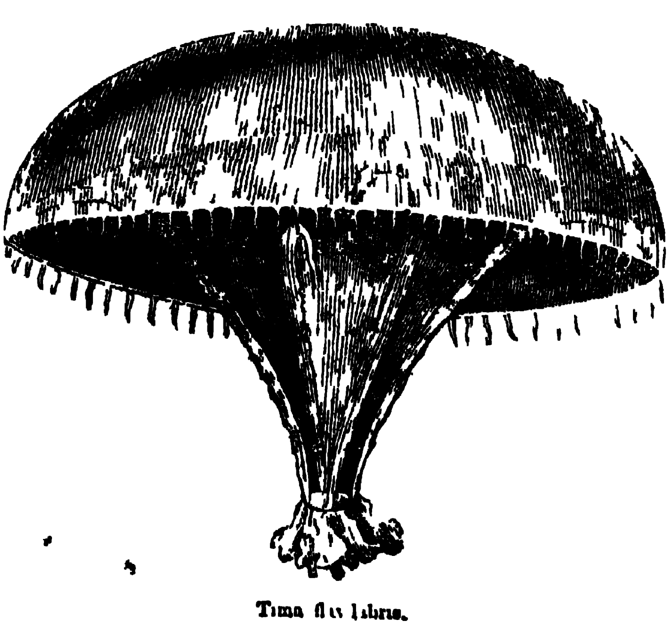
Habitat.—Coasts of Europe, Holland.



Thaumantias cymbaloidea.

Tima.

Generic Character.—*Body* hemispherical, depressed, furnished on its circumference with a circle of tentaculiform cirrhi, which are short and numerous, not much excavated beneath, and prolonged into a very thick conic peduncle, which is entirely exserted, and terminated by a plicated enlargement, buccal orifice at the centre of four labial appen-



Tima flavilabris.

dages; stomachal cavity in the enlargement of the peduncle, and giving origin to four ascending canals and communicating with a marginal canal.

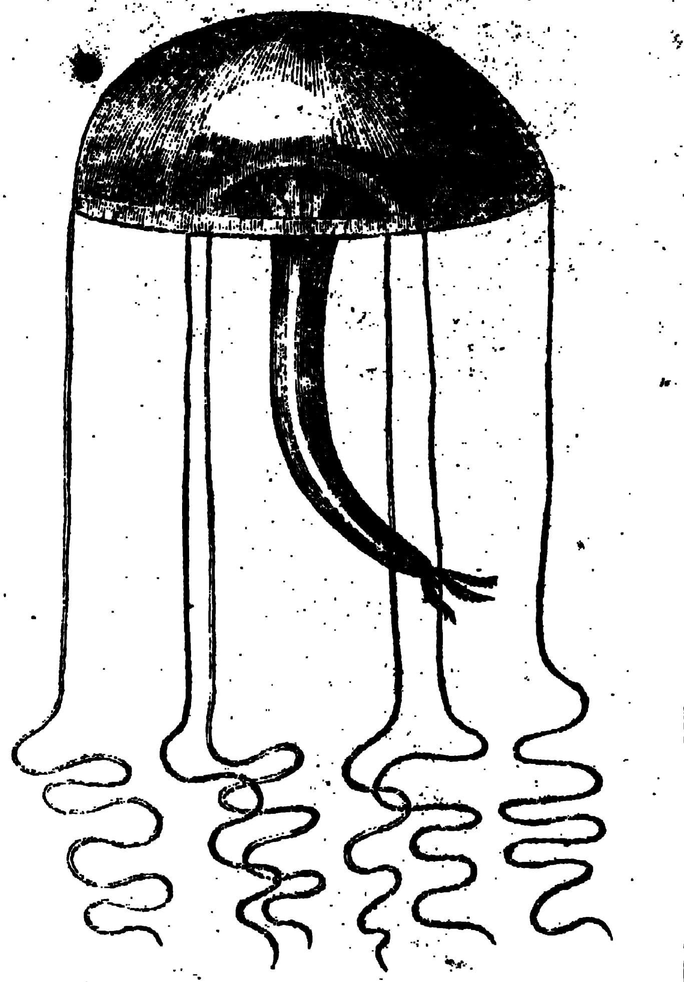
Example, *Tima flavilabris*.

Habitat.—The Azores.

Section IV.

Dianæa. (Quoy and Gaim.)

Generic Character.—*Body* hemispherical, furnished on its circumference with a small number of tentaculiform cirrhi; excavated beneath, and provided at its middle with a strong exserted proboscidiform appendage, with four brachideous appendages at its extremity.



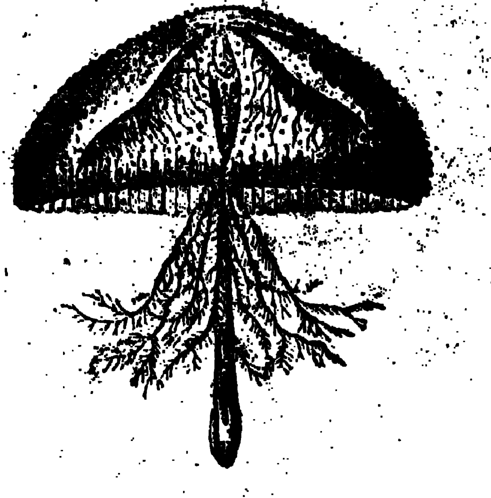
Dianæa.

Favonia.

Generic Character.—*Body* subhemispherical, with neither cirrhi nor tentaculiform marginal cilia; rather deeply excavated beneath, with a long, median, proboscidiform prolongation, having at its root six or eight brachideous appendages, furnished with radiciform suckers. Four ovaries.

Example, *Favonia Octonema* (*Orithyia Octonema*, Lam.).

Habitat.—South Seas.



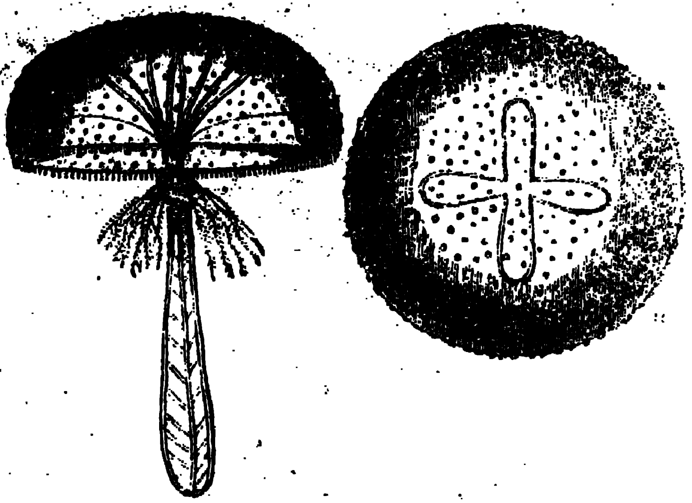
Favonia Octonema.

Lymnorea.

Generic Character.—*Body* subhemispherical, furnished on its circumference with very fine, short, and numerous tentacular cilia; rather deeply excavated beneath, and provided with a long proboscidiform prolongation, having at its base eight bifid and finely divided appendages. Four ovaries, in the form of a cross.

Example, *Lymnorea triedra* (*Dianœa triedra*, Lam.).

Habitat.—South Seas.



Lymnorea triedra.

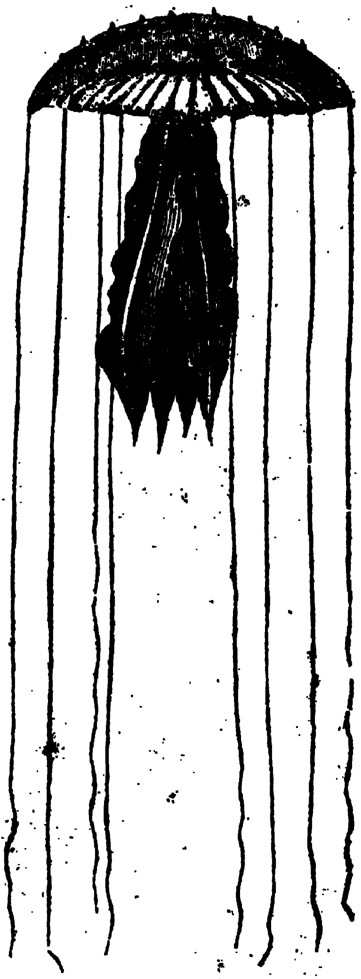
a, the disk seen from above.

Section V

Pelagia.

Generic Character.—*Body* subhemispherical, lobated, auriculated, furnished on its circumference with a few tentaculiform cirrhi; eight inferior apertures at the extremity of a fistulous? peduncle provided with four very strong and foliareous arms. Four ovaries. Stomach with cæciform appendages.

Example, *Pelagia Labiche*, Esch. (*Cyan. Labiche*, Quoy and Gaim.).

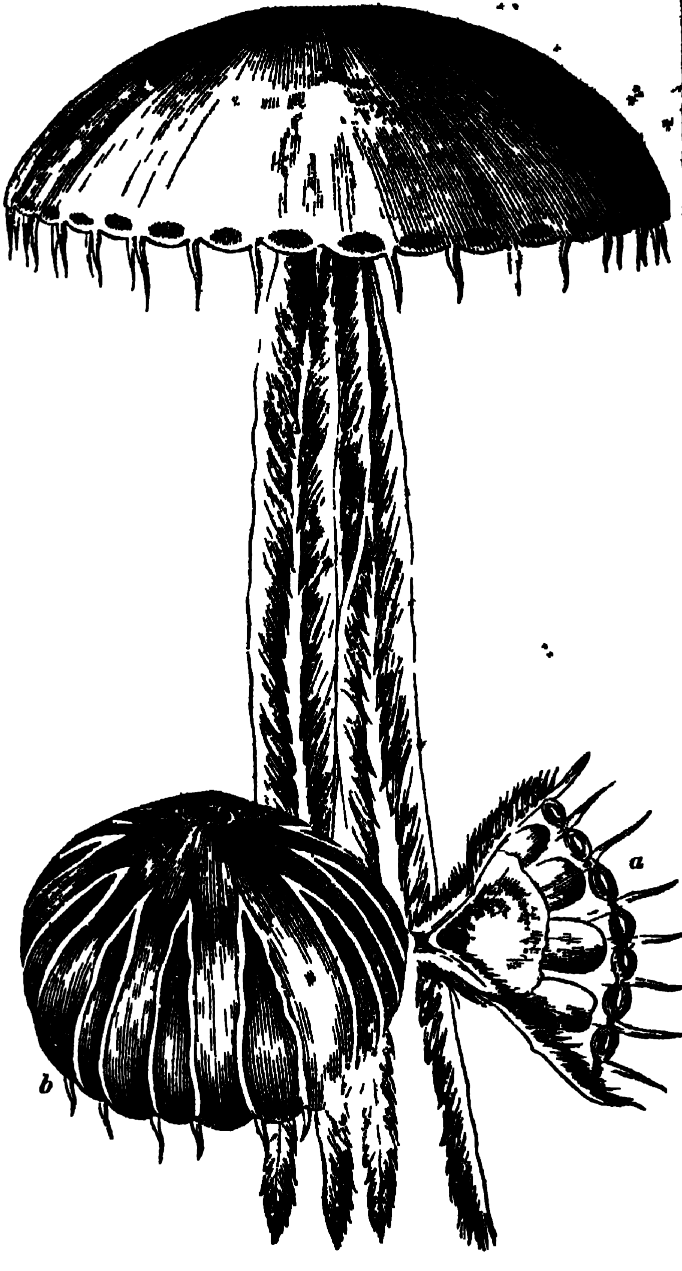


Pelagia Labiche.

Chrysaora.

Generic Character.—*Body* circular, hemispherical, festooned and provided with at least twenty-four tentaculiform cirrhi on its circumference; excavated internally into a considerable cavity with sacciform appendages; communicating externally by a single orifice, pierced in the centre of a median peduncle, provided with distinct brachideous appendages. Four ovaries.

Example, *Chrysaora lutea.*



Chrysaora lutea.

a, fourth of the disk or umbrella seen from below, *b*, disk without its appendages

Rhizostoma

Generic Character.—*Body* circular, hemispherical, provided on its circumference with lobes or festoons intermingled with auricles, largely excavated below, with four semilunar orifices, produced by four roots of insertion of a considerable pedunculated mass, afterwards divided into eight very complex brachideous appendages furnished with fibrillary suckers, without a median prolongation. Four ovaries, in the shape of a cross Stomachal cavity very large and vascular at its circumference

Example, *Rhizostoma Cuvieri.*

Habitat —European Seas

M de Blainville separates the genus into two divisions.

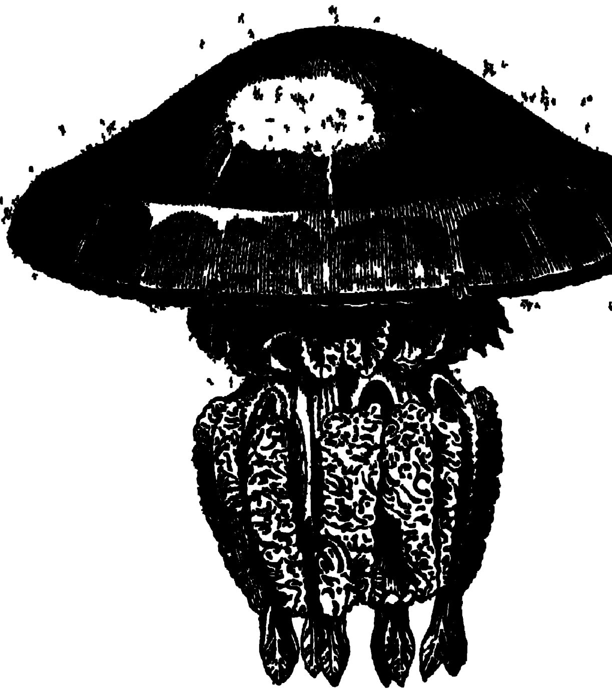
A

Species having a peduncle of insertion for the root, with radical appendages, besides those of the arms.

B.

Species having a very short peduncle of insertion, without radical appendages, besides the four bifid arms. (*Evagora,* Per)

We have given an illustration of the first. The species grow to a very large size



Rhizostoma Cuvieri

Fossil Impressions of Medusæ?

Mr Babbage, in his paper 'On Impressions in Sandstone resembling those of Horses' Feet,' December, 1836, in which he noticed those in the channel of a stream on the extensive moor called Pwll-y-Duon, about seven miles from Merthyr Tydvil, to which his attention was drawn by Mr. Guest of Dowlais, and the analogous casts in the old red sandstone of Forfarshire, there called *Kelpies' feet*, described some observations recently made by Mr. Lyell, on impressions left by *Medusæ* on the rippled sand near Dundee. On removing the gelatinous body of the animal, a circular space was exposed, not rippled, but having around half the border a depression of a horse-shoe form. These marks however were not considered by Mr. Lyell as identical with those called *Kelpies' feet*, but merely so far analogous as to invite further observations, and to make it desirable to possess drawings of the impressions which different species of *Medusæ* leave when thrown by the tide upon a beach of soft mud or sand (*Geol Proc*, vol ii)

PULMONELLA [Synoicum]

PULMONELLUM [Zoophytaria]

PULP is a name given in vegetable physiology and botany to such parts of plants as are semifluid This substance appears to the naked eye as a mucilaginous unorganised mass of the nature of a secretion; but it is in reality composed of very thin-sided cells which have little power of cohesion, and secrete in their interior a greater abundance of fluid than is usual. Pulp may therefore be regarded as young and imperfectly formed tissue filled with the secretions peculiar to the species. It is also in some cases, perhaps in all cases, mixed with an abundance of cinenchyma, or laticiferous tissue, which passes through it in all directions in the form of the most delicate ramifications The pulp of the grape affords a good example of this To the naked eye it appears to be nothing more than a fleshy homogeneous mass that may be compared to half-consolidated gum; but under the microscope it is found to be a congeries of oval transparent bags turgid with fluid and very easily ruptured; treated with iodine, they lose their transparency in some measure, and acquire a brown colour, when their limits become very distinct. The same re-agent stains still browner the vessels of the latex, whose course and position are thus brought clearly into view. In a few minutes however the colouring fades away in the latter, till they become as indistinct as they were before the iodine was applied: it is therefore necessary that the observation should be made as soon as the iodine has seized upon the latex or its tubes.

PULPIT. This term affords a striking instance of the great change of meaning and application which words frequently undergo, for, exclusively of the Latin termination, it is identical with *Pulpitum*, which signified that part of the Roman stage (distinguished from the orchestra) on which the actors recited and performed their parts The French *Pupitre* and the English *Pulpit* both come from the same source, but are dissimilar in signification; the former meaning merely a reading-desk, and *Chaire* (*Cathedra*) being the term that corresponds with our English one. The *Ambo* of the early Christians appears to have been different both in form and purpose from pulpits afterwards used for preaching, it being rather a low platform on which parts of the service were sung or recited. The most ancient pulpits now existing are supposed to be those in S. Lorenzo fuor delle Mura and S. Clemente at Rome; and these and other early pulpits of the same kind are of marble, with inlaid or mosaic compartments. In the church of S. Lorenzo at Florence, and several other modern basilicas there are two pulpits, one on each side of the nave. Great cost both of material and workmanship was frequently bestowed on pulpits; and some of them rank among the most celebrated monuments of art of their period. Niccola and Giovanni Pisano [Pisano], Donatello, Benedetto da Majano, and other eminent sculptors, employed their talents upon such works. The pulpit in the baptistery of Pisa, by Niccola, is hexagonal, and supported on seven columns, one at each angle and a central one. Giovanni Pisano executed that in the nave of the Duomo at Pisa; besides which there are two others in the same church, on the opposite sides of the choir. The *Pergamo* of Santa Croce at Florence, by B. da Majano, is greatly extolled by Vasari for the beauty of its reliefs and sculptures. The two *pergami* in S. Lorenzo at Florence, similarly placed opposite each other, are the work of Donatello; and of the mastery of composition displayed in their reliefs some idea may be formed from the specimen given of them in Cicognara's 'Storia della Scultura.' Notwithstanding the richness of such pulpits, and their elaborate execution, their general forms are not always the most pleasing or appropriate.

For a long time the pulpit appears to have been treated as an architectural feature of the interior, being constructed, if not of marble, of the same material as the rest. Among numerous other examples of Gothic stone-pulpits may be mentioned that in the nave of Strasburg cathedral, which is spoken of by Dr. Dibdin in terms of unqualified admiration, yet it is too much of a jumbled mass of ornament, and the whole of the canopy is in exceedingly bad taste, though not quite so vicious as that afterwards displayed in many Roman Catholic pulpits whose canopies are made in the form of clouds, curtains, palm-branches, and similar extravagancies. One of the most celebrated as a performance of art is the magnificent oak pulpit in the nave of St. Gudule, at Brussels; the whole is elaborately carved, and the pulpit itself is supported by figures representing Adam and Eve expelled from Paradise by the Angel.

Of stone-pulpits we have few remaining in this country; but there is one in Bristol cathedral, and another in Worcester, drawings and details of which latter are given in Pugin's 'Gothic Specimens.' It was originally erected in the nave, near the west end, but has been removed to the north side of the choir, and has been greatly disfigured by modern 'beautifying,' a flat sounding-board having been added to it in the shape of a bed-tester 'with paltry little scalloped festoons.' Even the pulpit itself is not remarkable for the elegance of its details, although its general form is good. This and another subject represented in the same work are instances of what may be termed *oriel pulpits*, being made to project after the fashion of an oriel [Oriel] from a pier or wall, and similarly corbelled below, instead of being supported from the ground. The second of the above-mentioned examples is in fact a small oriel in an angle of the outer court of Magdalen College, Oxford; and another, still more antient and curious—and we may add, more beautiful—is that at Beaulieu, Hants, which projects from an elegant open Gothic arch, and is supported, not on a corbelled and moulded oriel-stool, but on a short reversed spire, whose angles are decorated with small pillar-shafts, and the sides between them with foliage: a representation is given in the plates to the 'Glossary of Architecture.' Besides pulpits of this kind in the courts and cloisters of religious houses, there were others called *Preaching-Crosses*, from which sermons were delivered in the open air: Paul's Cross is a celebrated and well-known instance.

At the present day very few of the pulpits in our English churches have any beauty of form or character, but are frequently tasteless excrescences, encumbered with steps, reader's-desk, &c., and with respect to design, they are mere carpenter and joiner's work. Of late years the practice has been introduced of having two distinct pulpits, one for the reader, the other for the preacher, placed on opposite sides of the chancel; whereby architectural symmetry at least is kept up; yet this has been objected to as a reprehensible departure from strict usage, and likewise an absurdity, though if there be absurdity in having two pulpits when only one is required at a time, the absurdity is the same whether they be united together, one above the other, or placed singly. The two might very properly be combined, were the pulpit to be made a central object in a church, by being so placed at the altar-end of the chancel; but though it has occasionally been adopted, such mode is still more strongly objected to as being offensively indecorous, because in such case the pulpit must be before the altar. It might however be at such distance from it as not to obtrude upon it; and as to indecorum, when no irreverence is intended, but merely convenience is consulted, the impropriety becomes excusable, such situation being certainly the most advantageous of any, because the preacher is then both heard and seen more distinctly by the whole congregation than when he is stationed on one side of the church.

PULSE. [Heart.]

PULTAWA. [Poltawa.]

PULTENEY, WILLIAM, Earl of Bath, was born in 1682. He was the eldest son of a father of the same names, whose father, Sir William, had represented the city of Westminster in parliament with some distinction. The surname is supposed to have been taken from Pulteney in Leicestershire, where the family had been antiently established.

Young Pulteney, having been sent first to Westminster school and then to Christ Church, Oxford, afterwards travelled on the Continent, and on his return home was brought into parliament for the borough of Hedon in Yorkshire. This appears to have been in 1705. He was indebted for his seat to his guardian, Henry Guy, Esq., formerly secretary to the treasury, who afterwards left him a legacy of 40,000*l.* and landed property to the value of 500*l.* a year. Pulteney besides derived a considerable estate from his father, and he also received a large portion with his wife, Anna Maria, daughter of John Gumley, Esq., of Isleworth. All this wealth he increased by the practice throughout his life of a very rigid economy, 'which,' says Coxe, in his 'Memoirs of Walpole,' 'his enemies called avarice, but which did not prevent him from performing many acts of charity and beneficence.'

From his entry into the House of Commons, Pulteney attached himself to the Whig party, which was that of his family. He continued to sit for Hedon throughout the reign of Anne; but his name does not appear in the reported parliamentary debates during that reign. Coxe however states that he spoke for the first time on 'the Place Bill,' which he warmly supported. Place Bills, or proposals for excluding placemen from parliament, were brought forward in the House of Commons almost every session in this reign. Coxe also tells us that he distinguished himself on the question of the prosecution of Sacheverell; that he had made himself so obnoxious to the Tories, that when they came into power, in 1710, they revenged themselves upon the young orator by removing his uncle, John Pulteney, Esq., from the board of trade; that during the last four years of Queen Anne he not only took a principal share in the debates, but was admitted to the most important secrets of his party; and that on the prosecution of Walpole, in 1712, Pulteney defended his friend in a very elegant speech. He certainly was looked upon by this time as one of the leading men of his party.

On the accession of George I. Pulteney was appointed secretary-at-war; but when Walpole resigned in 1717, Pulteney also gave up his office. Soon after this however a coolness took place between the two friends, which was not removed by the appointment of Pulteney to the valuable sinecure of cofferer of the household on Walpole's resumption of office in 1720; but it was not till 1725 that Pulteney openly threw himself into the ranks of opposition, and began that course of bitter and incessant attack upon the minister, which did not cease till he had driven Walpole from power in 1742. Nor did he confine his exertions to his place in parliament; out of doors he entered into a close union with the party of which Bolingbroke was the head, and became the principal assistant of that writer in his paper called the 'Craftsman.' By his shining powers as a debater also, and the flaming patriotism with which he filled his harangues as leader of the opposition, he raised himself to the height of public favour, and was for some years the most popular man in the kingdom. When the administration of Walpole was at last overthrown, all the authority of the state seemed for a moment to lie at the feet of Pulteney; and he actually named the new ministry, taking to himself a seat in the cabinet without any office. But the arrangements that were made had in fact been all, it may be said, dictated by Walpole, who still retained his influence with the king, and secretly arranged with his majesty the course into which Pulteney was to be seduced with the view of destroying the popularity which was his chief strength. The composition of the new cabinet disappointed the expectations both of partisans and of the public; everything wore the appearance of its apparent maker having in fact made a compact and a compromise with Walpole; one considerable section of his late supporters (that headed by the Pitts and the Grenvilles) was wholly overlooked in the distribution of places; and the suspicion and sense of injury awakened by all this burst into a universal storm of indignation when, after the lapse of a few months, Pulteney walked into the House of Lords as earl of Bath. From this moment the late popular idol became quite insignificant. However he lived till 1764, chiefly occupied in nursing his private fortune, but still sometimes taking part in the debates and in public affairs. In the year 1760 he published 'A Letter to Two Great Men' (Mr. Pitt and the Duke of Newcastle), in which Horace Walpole, perhaps from no better authority than his own suspicion and spite, says he was assisted by his chaplain Douglas (the same who afterwards became successively bishop of Carlisle and of Salisbury). Walpole adds, 'It contained a plan of the terms which his lordship thought we ought to demand if we concluded a peace; it was as little regarded by the persons it addressed as a work of Mr. Pitt's would have been, if, outliving his patriotism, power, and character, he should twenty years after have emerged in a pamphlet.' ('Mems of George II,' ii. 412.) However the caustic annalist allows that 'it pleased in coffee houses more than it deserved.' Pulteney left no family, and his peerage became extinct on his death; but the title of baroness Bath was conferred in 1792, and afterwards that of countess of Bath in 1803, on Henrietta Laura Pulteney, daughter of Frances Pulteney, and Sir William Johnson, Bart. (who took the name of Pulteney), and great-granddaughter through her mother of a younger brother of the first earl's father, according to Coxe (who had his information from Bishop Douglas), or (according to other authorities) daughter of the earl's own younger brother Henry. This lady, who inherited the earl's fortune, died also without issue in 1808, and the title is now again extinct.

PULVINITES. [MALLEACEA, vol. xiv., p. 836; MARGARITACEA.]

PUMICE. [LAVA; VOLCANO.]

PUMP. [AIR-PUMP; HYDRAULICS.]

PUMPKIN is the vulgar name of the fruit of the *Cucurbita maxima*, a plant whose native country is not certainly known, but which is probably a variety of *C. Pepo*, a species inhabiting the Levant. It is, as is well known, an annual plant, sending forth many long succulent angular rough shoots, bearing leaves and flowers something like those of the cucumber. Its fruit is often of enormous size, specimens having been produced in this country weighing 220 lbs., and in hotter countries they are still larger. This kind of fruit is however only furnished by the variety called the yellow Potiron; in other varieties it is much smaller. The seed of the pumpkin should be raised in a frame, in a garden pot, after the same manner as the cucumber, and planted out upon a dunghill, or in any well-manured soil, as soon as the frosts are gone. Its young tender leaves and shoots constitute the best of all spinach; and the fruit, when ripe, is used for soup, or is baked with pears as an ingredient in tarts; when young, it may also be boiled and brought to table like vegetable marrow.

PUN. A pun has been defined by Addison (*Spectator*, No 61) to be 'a conceit arising from the use of two words that agree in the sound but differ in the sense.' Sometimes however the pun is effected by the employment of only one word, which is susceptible of a double application; as when one who had undertaken to pun upon any subject that should be given him, on being desired to make a pun on the king, answered that the king was no subject. Sometimes too the sound that is thus made to convey two ideas at once is not an entire word, but only a syllable. The definition moreover to be complete ought to have explained in what the effect of the conceit consists. It appears to be, as we have just hinted, in the novelty and unexpectedness of the signification or application presented by the pun—a novelty which always at least produces surprise, and often the lively collision of a grotesque or otherwise ludicrous image. Sometimes, though rarely, a pun has risen into a far higher region than the ludicrous; as for instance when Burke (or whoever else it was) exclaimed, 'What is (m)ajesty when deprived of its externals but a jest?' So, in his account of his ramble through London, in the 'Spectator' (No. 454), Steele tells us that when he looked down from one of the windows on the first floor of the Exchange upon the area below, 'where all the several voices lost their distinction and rose up in a confused humming,' a reflection occurred to him that could not have come into the mind of any but of one a little too studious; 'for,' he adds, 'I said to myself, *with a kind of pun in thought*, what nonsense is all the hurry of this world to those who are above it?' It may be observed that both these last-mentioned puns arise not out of the similar sound of two words, but out of the double application of one—*externals* in the former, *above* in the latter.

A sketch of the history of puns has been given by Addison in a well known paper in the 'Spectator' (No. 61), in which he traces the existence of the practice from the time of Aristotle downward. The figures of speech or turns of expression known among the Greeks by the names of the paragramma (παράγραμμα), and the paronomasia (παρονομασία), the antanaclasis (ἀντανάκλασις), and the ploke (πλοκή), were often merely what we should now call puns. Addison observes that Aristotle, in the eleventh chapter of his 'Rhetoric,' describes different kinds of puns or paragrams, among the beauties of good writing, and produces instances of them out of some of the greatest authors in the Greek tongue. 'Cicero,' he adds, 'has sprinkled several of his works with puns, and in his book, where he lays down the rules of oratory, quotes abundance of sayings as pieces of wit, which also upon examination prove arrant puns.' 'I do not find,' he afterwards says, 'that there was a proper separation made between puns and true wit by any of the antient authors except Quintilian and Longinus.' We may also refer to another very clever paper in the 'Guardian' (No. 36), attributed to a writer of the name of Birch, which contains what is called 'A Modest Apology for Punning.' In the introduction to this paper the distinction is happily enough drawn between the extemporaneous puns of conversation and the punning in deliberate and grave composition, which in this country, in the early part of the seventeenth century, used to be reckoned eloquence and fine writing. 'I look,' says the author, 'upon premeditated quibbles and puns committed to the press, as unpardonable crimes. There is as much difference betwixt these and the starts in common discourse, as betwixt casual rencounters and murder with malice prepense.'

The philosophy of the pun, and its relation to alliteration, rhyme, and other forms of speech, the effect of which is derived partly from the sound, might afford matter for some speculation.

PUNCH, the name of the principal character in a well known puppet-show which is exhibited about the streets, and which appears to have originated in Italy; the name is a corruption of Policinella, the Neapolitan clown, who is generally the leading character in puppet-show performances. But the show itself, or rather the puppets, are styled by the Italians 'fantoccini.' Galiani, in his 'Vocabolario del Dialetto Napoletano,' gives the following account of the origin of Policinella, or rather Polecenella, as it is pronounced by the Neapolitans. A company of strolling comedians once arrived at the town of Acerra near Naples, in the season of the vintage. The vintagers are, by traditional custom, licensed jesters. The comedians fell in with a band of vintagers, who assailed them with jokes and vociferations, which the comedians retorted. One of the vintagers, called Puccio d'Aniello, or Puccio the son of Aniello, remarkable for a very large nose and grotesque appearance, was the most forward and witty of all his band, and at last the comedians were fairly beaten out of the field. Reflecting on this occurrence, the comedians thought that a character like that of their antagonist Puccio d'Aniello might prove very attractive on the stage, and they proposed an engagement to him, which he accepted. The engagement proved profit able to both parties; and the comedians had crowded houses wherever they went. After some years, Puccio d'Aniello died, but his place was filled by a well-taught adept in his art, who assumed his name, softened into Polecenella, and also his manner and costume, [illegible] a mask which perpetuated the features of the facetious visage. By degrees, personifications of the original Polecenella were multiplied all over the country, and the name [illegible] character [illegible] thus become immortal. It is remarkable [illegible] the district in which Acerra is situated was remarkable in antient times for that kind of dramatic wit and farcical humour which has made the reputation of the modern Polecenella. [ATELLANÆ FABULÆ.]

PUNCTUATION is the art of dividing written or printed composition into sentences and clauses, by points or stops, so as to indicate the closer or more remote connection of the several parts. It serves to elucidate the sense, and thus also assists the delivery, since the latter must have reference to the grammatical construction.

The elements of a system of punctuation are discoverable in antient times. Aristotle mentions the subject in his 'Rhetoric' (iii. 5); Jerome, in the fourth century, attended to the punctuation of the sacred books which he revised; about the middle of the fifth century Euthalius published an edition of the four Gospels, and afterwards of the Acts, and of all the apostolical Epistles, in which he divided the New Testament into *stichoi* (στίχοι), or lines, regulated by the sense, so that each terminated where some pause was made in the reading; and in the Alexandrine manuscript, which may be referred to the fourth or fifth century, we find not only a break at the end of each paragraph, but stops, similar to the higher part of our colon, inserted, though sparingly, in the body of the sentences.

The invention of the modern system of punctuation has been attributed to Aristophanes, a grammarian of Alexandria; but the subject was very imperfectly understood till the close of the fifteenth century, when the learned Venetian printers, the Manutii, increased the number of the signs, and established some fixed rules, which have been so generally adopted, that we may regard them as the inventors of the present system.

The points used in English composition are:

The comma, marked thus	,	The period or full stop	.
The semicolon	;	The interrogation	?
The colon	:	The admiration	!

to which may be added the dash —, the apostrophe ', and the parenthesis ( ).

It is considered that the proper length of the pause at a comma is while we may count *one;* at a semicolon *two;* at a colon *three;* and at a period *four*. But it will be easy to show that there is frequently a much greater separation of the sense, and that there ought therefore to be a longer pause at some commas than at others. Thus in the following sentence there should evidently be a longer pause after *instance*, than after *candour, fortitude, charity*, and *generosity*, though these words are all followed by the same mark of grammatical punctuation, namely the comma: 'The qualities of candour, fortitude, charity, and generosity, for instance, are not in their own nature virtues; and if ever they deserve the title, it is owing only to justice, which impels and directs them.'

The form and structure of sentences are so various, that it would be difficult, if not impossible, to lay down rules for punctuation which shall meet every case which can occur. The following may serve as a general guide:

I. The *comma* is used,—

1. To throw together such similar parts of speech as are joined in pairs by the conjunction *and*.

2. To separate the several members of a series, *i.e.* a succession of similar words or members.

3. To separate from the rest of the sentence such clauses as are added by way of explication or illustration, or such as are really parenthetical, though they may not be so marked.

4. To separate from the rest of the sentence words in the vocative case.

5. In many cases to separate the relative and the antecedent.

6. To separate from the rest of the sentence such clauses as are introduced by a connective, conditional, or exceptive particle, or by an adverb of time or place; and to separate antithetical clauses, and such comparative clauses as are introduced by the adjectives *like, better*, by the conjunctions *as, so, than*, by the adverbs *how much, more, oftener, rather*, unless the comparative member at the end be short.

II. The *semicolon* is used when a longer pause is required than at a comma, but when the sense is imperfect, and [illegible] some other member to render it complete. Or it is [illegible] a compound sentence into two or more parts which are not so closely connected as those which are [illegible]ted by commas only, nor yet so independent and perfect as those which admit a colon: thus—

'Life, with a swift though insensible course, glides away; and like a river which undermines its banks, gradually impairs our [illegible].'

'As there is a worldly happiness which God perceives to be only disguised misery; as there are worldly honours which in his estimation are a reproach; so there is a worldly wisdom which in his sight is foolishness.'

III. The *colon* may be inserted—

1. When a member of a sentence is complete in itself, but is followed by some additional remark or illustration of the subject: thus—

'Do not flatter yourself with the idea of enjoying perfect happiness: there is no such thing in the world.'

'Keep close to thy business: it will keep thee from wickedness, poverty, and shame.'

2. When several semicolons have preceded, and when a longer pause is necessary in order to mark the connecting or concluding sentiment: thus—

'A divine legislator uttering his voice from heaven; an almighty governor stretching forth his arm to punish or reward; informing us of perpetual rest prepared hereafter for the righteous, and of indignation and wrath awaiting the wicked: these are the considerations which overawe the world, which support integrity, and which check guilt.'

3. A colon is generally placed at the close of the words which introduce an example, a quotation, a saying, a speech, or a narrative: thus—

'The earl of Chatham made an excellent speech, from which the following is a brief extract: "I know that the conquest of British America is an impossibility."'

IV. The *period* or full stop is placed at the end of a sentence, *i.e.* at the end of such an assemblage of words as present a complete and independent sense: thus—

'Truth is the basis of every virtue.'

'The Latin tongue is now called a dead language, because it is not spoken as the mother tongue of any nation.'

In some sentences an additional clause is included, which does not modify the preceding: thus—

'The law of the Lord is perfect, converting the soul.'

These are called *loose sentences.*

The *note of interrogation*, as its name implies, is placed at the end of every question.

The Spaniards place this mark also *at the beginning* of interrogative sentences; and it must be acknowledged that in some cases this is an advantage, as it suggests to the reader from the first the tones of voice which are suitable.

The *note of exclamation* or *admiration* is placed at the end of such words or clauses as express any strong passion or emotion of the mind.

The *dash* should be used sparingly: it is introduced with propriety where a sentence or dialogue breaks off abruptly; where the sense is suspended, and continued after a short interruption; where a significant pause is required; where there is an unexpected turn in the sentiment, or a sort of epigrammatic point; when a sentence consists of several clauses which form the nominative to a verb following, or lead to a conclusion or inference, and it is desirable to assist the eye more readily than by semicolons; and in some cases to indicate an ellipsis.

The *apostrophe* shows the omission of a letter, as in *form'd, e'en, e'er*, used chiefly in poetry; and in the genitive case, as *man's, boys'*, both in prose and poetry.

The *parenthesis* marks a clause, which should contain some necessary information, or a useful remark, introduced into the body of a sentence *indirectly*, but which might be omitted without doing injury to the sense or the construction.

(For more ample illustrations of this subject, see Steel's *Elements of Punctuation*, 12mo., London, 1786; *Principles of Punctuation*, by the Rev. C. Hartley, 18mo., London, 1818; and *The Principles of English Punctuation*, by G. Smallfield, 18mo., London, 1838.)

It has been remarked above, that one use of the pauses is as a guide to reading; but it must not be supposed that those which are usually inserted even in well punctuated books are sufficient for this purpose. Thus in the following sentence we find only one pause, namely after *fine* :—

'The descriptive part of this allegory is likewise very fine, and full of sublime ideas.'

But were it merely for the purpose of taking breath, it would be necessary to pause in the first clause, and the most suitable place for doing this is after *allegory*. The words *the descriptive part of this allegory* stand in the relation of a compound nominative case to the verb; and it may be laid down as a rule that there should always be a pause in good reading after such a combination of words as this. There should be a pause in reading between the object and the modifying words in the inverted order, as after *man*, in the following sentence: 'He was a man patient, sober, honest, and industrious;' and after *love* in the following: 'To love wisely, rationally, and prudently, is, in the opinion of lovers, not to love at all.' There should also generally be a pause after prepositions. In accordance with these remarks, we should place a pause in reading after *passion*, *admiration*, *effects*, and *behaviour*, in the following sentence, though the printer would insert none at all; and bishop Lowth lays it down as a rule, that a simple sentence, *i.e.* one consisting of one subject and one finite verb, does not admit of a pause between any of its parts:

'A violent passion for universal admiration produces the most ridiculous effects in the general behaviour of women of little sense.'

When it is also considered, as has been before remarked, that the points are not sufficiently discriminative, it will be perceived that they are, as at present placed, a very imperfect guide to the pauses which good reading requires.

(See this subject treated at length in Walker's *Elements of Elocution*, and Wood's *Grammar of Elocution.)*

PUNIC WARS (*Punica bella*), the three great wars between the Carthaginians (*Pœni*) and the Romans.

I. The *First Punic War*, which lasted nearly twenty-three years (A.U.C. 490-513, or B.C. 264-41), arose out of the application of the Mamertines of Messana to Rome (B.C. 264) for aid against the Carthaginians, and Hiero, king of Syracuse. [CARTHAGE, vol. vi., p. 327.] The senate of Rome, who had only six years before severely punished in the Campanians of Rhegium a similar act of piracy to that by which the Mamertines had established themselves at Messana, refused to take part with the latter against their own allies, Hiero and the Carthaginians. Upon this the consuls, Appius Claudius Caudex and Marcus Fulvius Flaccus, brought the subject before the people in the comitia, and, by appealing to their jealousy of the Carthaginian power, and by representing the gain to be made by a contest with so wealthy a state on the fertile plains of Sicily, they prevailed upon them to espouse the cause of the Mamertines.

At the beginning of the war the Carthaginians were masters of the sea, and possessed a well furnished treasury which enabled them to enlist a large number of mercenaries These hired forces however were no match for the citizen soldiers of Rome, whose native vigour more than compensated for her limited resources.

While preparations were being made to commence the war, Caius Claudius crossed over to Messana, and treacherously seized Hanno, the Carthaginian governor of that city, who surrendered the citadel to purchase his freedom, and for this act of weakness was crucified on his return to Carthage. Hiero and the Carthaginians now blockaded Messana; but the consul Appius Claudius succeeded in eluding the Carthaginian fleet and carrying over his army from Rhegium to Messana, where he defeated first the Syracusans and then the Carthaginians, and, after raising the siege of Messana pursued Hiero to the walls of Syracuse. This city however and that of Egesta resisted his attempts to take them, and, after overrunning the open country, he returned to Rome. In the next spring (B.C. 263) two consular armies were sen to Sicily, and Hiero, after severe losses, made a peace with the Romans, and remained their firm ally for the rest o his life. In the next year (B.C. 262), the Romans took Agrigentum, after a siege of about seven months; but they now began to feel their operations greatly embarrassed by the naval supremacy of the Carthaginians. They resolved therefore (B.C. 261) to have a fleet. Hitherto their only vessels had been triremes and penteconters; the quinqueremes (which Dr. Arnold happily terms 'the line-of-battle ships of that period') they did not even know how to build. They found a model in a Carthaginian vessel which had accidentally fallen into their hands, and in two months they built a fleet of a hundred ships, the crews having in the mean time been trained to row. With this fleet the consul Caius Duilius defeated the Carthaginian fleet under Hannibal off Mylæ (*Melazzo*), on the northern coast of Sicily, taking or destroying about fifty ships and 10,000 men. This naval victory, the first which the Romans ever gained, appears to have been chiefly owing to their use of a peculiar machine for grappling with and boarding the enemy's ships. Its moral effect was of the greatest consequence, and the people showed their sense of its importance by the extraordinary honours which they conferred upon Duilius. After three years of indecisive warfare, the Romans gained another naval victory off the Liparæan Islands (B.C. 257), which emboldened them to carry the war into Africa. They prepared during the winter a fleet of 330 ships, the crews of which, exclusive of fighting men, amounted to nearly 100,000 men, and in the spring of the year 256 B.C., the two consuls, L. Manlius Vulso and M. Atilius Regulus, crossed over to Africa, after defeating a Carthaginian fleet of 350 ships off Ecnomus, on the southern coast of Sicily. They landed at the fortress of Aspis or Clypea, and proceeded to ravage the fertile country around. After some weeks, Manlius was called back to Rome, and Regulus was left in Africa with 15,000 foot and 500 horse. He overran the country, which was destitute of fortified places, without opposition, and established his head-quarters at Tunes, about fifteen miles from Carthage. The Carthaginians now sued for peace, but Regulus treated their envoys with the utmost arrogance, and offered them terms so intolerable, that they rejected them indignantly. At this period there arrived at Carthage a Spartan officer named Xanthippus, who had already acquired considerable military fame. The Carthaginians put their armies under his command, and soon completely defeated the Romans, taking Regulus prisoner (B.C. 255). The fortress of Clypea was now all that remained to Rome of her African conquests, and this was immediately evacuated. The fleet which carried away the remains of the Roman army suffered a disastrous shipwreck on the southern coast of Sicily. The Carthaginians now renewed their efforts in Sicily: Agrigentum was recovered by Carthalo, and Hasdrubal was entrusted with the chief command in the island, while Panormus was taken by the Romans. The loss of another fleet by shipwreck (B.C. 253) put a stop for a time to the naval exertions of the Romans. During the next two years the Romans gained no ground, and their armies fell into a bad state of discipline; but in the year 250 B.C., L. Cæcilius Metellus gained a great victory over Hasdrubal at Panormus. In this battle thirteen noble Carthaginians had been taken prisoners, and, in order to recover them, the Carthaginians sent an embassy to Rome to propose an exchange of prisoners. Regulus accompanied the embassy, having promised to return if it failed. He met the senate, advised them to refuse the exchange, and, upon his counsel being followed, he returned to Carthage, where he soon after died. In the autumn of this year the Romans laid siege to Lilybæum, the only place, except Drepanum, which the Carthaginians retained in Sicily; but though two consular armies were engaged in the siege, the town resisted all their attacks, and they were compelled to turn the siege into a blockade, but even then they were unable to prevent the introduction of supplies and reinforcements by sea. In the year 249 B.C., the Carthaginian general Adherbal gained a great naval victory over P. Claudius, the consul, off Drepanum, and in the same year two Roman fleets, consisting of corn-ships and ships of war, were totally wrecked off Cape Pachynus, and the war continued for some time in favour of the Carthaginians. In the year 247 B.C., the great Hamilcar Barcas was appointed to command the Punic forces in Sicily. He conceived the plan of forming a body of infantry able to cope with that of the Romans, and for this purpose he avoided pitched battles, and kept up an incessant war of posts, fixing his head-quarters first on the summit of an almost impregnable table-mountain near Panormus (now Monte Pellegrino), and afterwards on Mount Eryx, and thus for six years he baffled all the Roman armies. At length the Romans, by an extraordinary effort, sent another powerful armament to sea, under the command of the consul Caius Lutatius Catulus (B.C. 242). The Carthaginians hastily equipped a fleet, and sent it out under the command of Hanno. The fleets met at the Aegates, a group of islands off the western point of Sicily, and Lutatius was completely victorious. This battle put an end to the war. Both parties were exhausted by the struggle, and though victory had declared in favour of the Romans, they could not hope to reduce Lilybæum, Drepanum, and Eryx, especially when defended by so firm and able a man as Hamilcar, without very great trouble, while the Carthaginians could look for nothing better than merely to retain these places. A peace was therefore concluded on the following terms:—that the Carthaginians should evacuate Sicily and the adjacent small islands; that they should pay 3200 talents to Rome within ten years; that they should release all Roman prisoners without ransom; and that they should make no war on Hiero or his allies.

Thus ended the first Punic war, which was a contest for the possession of Sicily and the sovereignty of the sea, by the loss of which, Heeren remarks, the fate of all the other external possessions of Carthage was already predetermined; while the Romans, by the expulsion of the Carthaginians from Sicily, were delivered from a danger which threatened the security of their Italian empire. The next and fiercest struggle of the rival republics was for the complete supremacy of the one over the other; the third and last was, on the part of Carthage, for existence.

II. The causes of the *Second Punic War* are to be found in the position in which the two parties were left by the first; the Romans still dreading the power of Carthage, and the Carthaginians burning to avenge their losses. This was especially the feeling of Hamilcar Barcas and his party, and it is not improbable that the war would have been renewed in his life-time, but for the insurrection of the mercenaries. [Carthage; Hamilcar.] After concluding the mercenary war, Hamilcar prepared for the contest by bringing Spain under the Carthaginian rule, and forming there a veteran army; and above all, by training up his son Hannibal to be the uncompromising enemy of the Romans. In the meantime, Rome committed an act of wanton aggression by seizing upon the island of Sardinia (B.C. 237). At length, in the year 218 B.C., Hannibal commenced the war by taking Saguntum, a town on the eastern coast of Spain, some distance south of the Ebro, which was under Roman protection, and by crossing the Ebro, which had been fixed by a treaty (B.C. 226) as the boundary between the Roman and Carthaginian possessions. By a master-stroke of warlike policy, he resolved to make Italy itself the theatre of war. The details of his march into Italy, his victories at the Ticinus, the Trebia, and the Trasimene lake, his complete overthrow of the Romans at Cannæ, the indecisive progress of the war in the following years, during which Fabius Maximus and Marcellus kept Hannibal in check, and the complete turn of the scale in favour of the Romans by the destruction of Hasdrubal's army (B.C. 207), are given under Hannibal. The exploits of Scipio Africanus in Spain, his invasion of Africa, and his defeat of Hannibal at Zama (B.C. 202), are related in the article Scipio. The battle of Zama concluded the war. Peace was granted to the Carthaginians on the following terms: they were to retain only their territory in Africa; they were to give up all their ships, except ten triremes, and all their elephants; they were to pay the Romans 10,000 talents, at the rate of 200 a year; they were to commence no war without the consent of Rome; and to restore to Massinissa all his hereditary possessions. Thus Carthage became little more than a vassal of Rome. But this was not enough. It was deemed necessary by a powerful party at Rome that Carthage should be destroyed, and for this end, to which they were also urged by personal motives, they induced the people to engage in a third war, for which a pretext was easily found. [Carthage, vol. vi., p. 327-328.]

III. The *Third Punic War* began in the year 149 B.C., and lasted only three years. Its unprovoked commencement, its treacherous conduct, and its cruel consummation reflect disgrace upon Rome. When the Carthaginians found that the Romans were resolved on their destruction [Carthage, p. 328], they made the most vigorous preparations for a resolute defence. The consuls Censorinus and Manilius attacked the city on opposite sides, but were repulsed. Other reverses followed. The consuls of the following year (148, B.C.) were equally unsuccessful. But in the next year (147 B.C.) Scipio Æmilianus finished the war by the capture of Carthage. [Scipio.] By a decree of the senate, the city was razed to the ground, and Africa was made a Roman province.

(Polybius; Livy; Appian's *Punica* and *Hannibalian War*; Plutarch, *Marcellus*, *Fabius Maximus*; Zonaras; Niebuhr and Arnold's *Histories of Rome* (for the first Punic War), Heeren's *Manual of Antient History*; Clinton's *Fasti Hellenici*.)

PU'NICA, a genus of plants of the natural family of Myrtaceæ, sometimes distinguished, in consequence of its having two verticels of capsules developed instead of one, from Myrtaceæ under the name of Granateæ. The genus consists of only a single species, the celebrated Pomegranate, with a dwarf variety, which is sometimes considered a distinct species. The pomegranate has from the earliest periods formed an object of attraction in the countries from Syria to the north of India, where it grows in perfection, as well as in the north of Africa; and this, as well from its shining dark-green foliage, as from its conspicuous flowers, of which the flower-cup and petals are both of a crimson colour, while its large red-coloured fruit, filled with juicy pleasant-flavoured pulp, which covers its numerous seeds, makes it an object of desire in hot countries. Thus we find it mentioned in the Bible under the name Rimmon (*Numbers*, ch. xiii.), and we hence learn that it was cultivated in Egypt and also in Palestine; by the Arab authors it is called *rooman*, and by the Persians *anar*, and it is probably indigenous all along the mountains from the Caucasus to the Himalayas, where it is described by Dr. Royle as being found in a wild state. Forster describes the pomegranate as being delicious in most parts of Persia; and Burnes states that the famous pomegranates without seeds are grown in gardens under the snowy hills near the Caubul river.

The pomegranate was well known to the Greeks, being the Roa of Theophrastus and the Roia of Dioscorides. Hippocrates mentions it by what is supposed to be its Phœnician name, *side*. By the Romans it was called Punica, and Punicum malum, from having been introduced from Carthage. Besides the fruit, the parts employed by the antients were the double flowers, which were called *balaustion;* the pericarp, from its leathery consistence, called *malicorium*, was used for its astringent properties; while the bark of the root was considered an efficient anthelmintic. In the East, where so much has remained stationary, the different parts continue to be employed for the same purposes; and Dr. Royle mentions that in India *buloositon* is given as the Greek name of the double flower. The rind of the wild fruit is much preferred for astringent purposes, and forms in the present day an article of commerce from the Himalayas to the plains of India. The bark of the root, being also still employed in India for the expulsion of intestinal worms, was made known as a recent discovery in India, in consequence of a Mohammedan practitioner having cured a European gentleman there of tape-worm with great ease. He had no doubt learned this property of the bark of pomegranate from the translations of Dioscorides, which are incorporated in most of the Mohammedan works on Materia Medica, affording a striking instance of facts once well known being forgotten until they are rediscovered. It is remarkable that the African slaves in the West Indies are also acquainted with this property of the root of the pomegranate, which they must have learned in their own country, probably from the prevalence there of Mohammedan works on medicine, or of the practice which is inculcated in them.

PUNISHMENT. The verb *to punish* (whence the noun substantive *punishment*) is formed from the French *punir*, according to the same analogy as *furnish* is formed from *fournir*, *tarnish* from *ternir*, *finish* from *finir*, &c. The French *punir* is derived from the Latin *punire*, antiently *poenire*, which is connected with *poena* and the Greek *poiné* (ποίνη). Poiné signified a pecuniary satisfaction for an offence, similar to the *wergeld* of the German codes: *poena* had doubtless originally a similar sense; but in the Latin classical writers its meaning is equivalent to that of our word *punishment*.

Punishment may be inflicted on men by a supernatural being or by men; and it may be inflicted on them either in the present life, or in the existence which commences after death. Punishment may likewise be inflicted by men on the more intelligent and useful species of animals, such as horses and dogs. In the following remarks, we confine ourselves to punishment inflicted by man on man in the present life.

The original idea of punishment was, pain inflicted on or endured by a person as a satisfaction or atonement by him for some offence which he had committed. (Grimm, *Deutsche Rechtsalterthümer*, p. 646.) According to this conception of punishment, it appeared to be just that a person should suffer the same amount of pain which he had inflicted on others by his offence; and hence the origin of the retaliatory principle of punishment, or the *lex talionis*. This principle is of great antiquity, and is probably the earliest idea which all nations have formed concerning the nature of punishment. It occurs among the early Greeks and was attributed by them to their mythical prince and judge of Hades, Rhadamanthys. They embodied it in the following proverbial verse:—

εἴ κε πάθοι τά κ' ἔρεξε, δίκη κ' ἰθεῖα γένοιτο.
(Aristot., *Eth. Nic.*, v. 8.)

The *talio* was also recognised in the Twelve Tables of Rome (*Inst.*, iv. 4, § 7), and upon it was founded the well-known provision of the Mosaic law, 'an eye for an eye, and a tooth for a tooth:' a maxim which is condemned by the Christian morality. (*Matth.*, v. 38-40; and Michaelis, *Commentaries on the Laws of Moses*, vol. iii., art. 240-2.)

The infliction of pain for the purpose of exacting a satisfaction for an offence committed is *vengeance*, and punishment inflicted for this purpose is *vindictive*. [ANGER.]

By degrees it was perceived that the infliction of pain for a vindictive purpose is not consistent with justice and utility, or with the spirit of the Christian ethics; and that the proper end of punishment is not to avenge past, but to prevent future offences. (Blackstone's *Commentaries*, vol. iv., p. 11.)

This end can only be attained by inflicting pain on persons who have committed the offences; and as this effect is also produced by vindictive punishment, vindictive punishment incidentally tends to deter from the commission of offences. Hence Lord Bacon justly calls revenge a sort of

the vindictive principle often fails to produce the desired purpose, and moreover often involves the infliction of an unnecessary amount of pain. Thus when an offence is expunged from the criminal code, all persons suffering punishment for it ought at once to be pardoned; inasmuch as their punishment cannot produce any preventive effect. Again, the degree of the punishment will often be placed too high, if regard is had merely to the suffering produced by the offence in the individual case, or to the moral turpitude implied by it, and not to the facility or difficulty of prevention, or the mischievousness of the class of offences. All punishment is an evil, though a necessary one. The pain produced by the offence is one evil; the pain produced by the punishment is an additional evil; though the latter is necessary, in order to prevent the recurrence of the offence. Consequently a penal system ought to aim at economising pain, by diffusing the largest amount of salutary terror, and thereby deterring as much as possible from crimes, at the smallest expense of punishments actually inflicted; or (as the idea is concisely expressed by Cicero), 'ut metus ad omnes, pœna ad paucos, perveniret' (*Pro Cluentio*, c. 46).

It follows from what has been said, that it is essential to a punishment to be *painful*. Accordingly, all the known punishments have involved the infliction of pain by different means, as death, mutilation of the body, flogging or beating, privation of bodily liberty by confinement of various sorts, banishment, forced labour, privation of civil rights, pecuniary fine. The punishment of death is called *capital* punishment: other punishments are sometimes known by the name of *secondary* punishments. Moreover, the pain ought to be sufficiently great to deter persons from committing the offence, and not greater than is necessary for this purpose.

A punishment ought further to be, as far as the necessary defects of police and judicial procedure will permit, *certain*; and also, as far as the differences of human natures and circumstances will permit, *equal*.

If a punishment be painful, and the pain be of the proper amount, and if it be likewise tolerably equal and certain, it will be a good punishment.

The qualities just enumerated are those which it is most important that a punishment should possess. But it is sometimes thought desirable that a punishment should possess other qualities than those which we have enumerated.

1. Since the time when it has been generally understood that punishment ought not to be inflicted on a vindictive principle, the deterring principle of punishment (which necessarily involves an infliction of pain) has been sometimes overlooked, and it has been thought that the end of punishment is the reformation of the person punished. This view of the nature of punishment is erroneous in excluding the exemplary character of punishment, and thus limiting its effects to the persons who have committed the offence, instead of comprehending the much larger number of persons who may commit it. The reformation of convicts who are suffering their punishment is an object which ought to enter into a good penal system; but it is of subordinate importance as compared with the effect of the punishment in deterring unconvicted persons from committing similar offences.

2. It is likewise sometimes thought that punishment is inflicted for the purpose of getting rid of offenders, or of rendering them physically incapable of repeating their offence. Death has often been inflicted for this purpose; and bodily disablements of different sorts have been inflicted for the same end; transportation has likewise been often recommended on the ground of its getting rid of convicts. This view of punishment errs in the same manner as that just examined; inasmuch as it is confined to the persons who have actually committed offences. If all offenders were removed to a place of reward, they would be got rid off, but not punished. The principle of getting rid, or confinement, for the purpose of protecting society against the known dangerous tendencies of a person, is properly applicable in the case of madmen. It may also be rarely employed with advantage in the case of mischievous political adventurers and conquerors; as *e.g.* Napoleon Bonaparte.

A detailed account of the punishments which have been used in different nations may be found in different works on antiquities and law books. See, for the Greeks, W

Europe generally in the middle ages, Grimm
Rechtsalterthümer, b. v., ch. 3; for modern France, *L*
Code Pénal, liv. 1; and for England, Black
ment

The subject of *Secondary Punishments* (the principal of which are in this country transportation and imprisonment), is treated under TRANSPORTATION. We will here make a few remarks on the subject of *Capital Punishments*.

An idle question is sometimes raised as to the right of a government to inflict death as a punishment for crimes, or, as it is also stated, as to the lawfulness of capital punishment. That a government has the power of inflicting capital punishment cannot be doubted; and in order to determine whether that power is rightfully exercised, it is necessary to consider whether its infliction is, on the whole, beneficial to the community. The following considerations may serve to determine this question respecting any given class of crimes. Death is unquestionably the most formidable of all punishments; the common sense of mankind and the experience of all ages and countries bear evidence to the truth of this remark. Moreover, capital punishment effectually gets rid of the convict. It may be added, as subordinate considerations, that death is the cheapest of all punishments, and that it effectually solves all the difficult practical questions which arise as to the disposal and treatment of convicted criminals. On the other hand, capital punishment, from its severity and consequent formidableness, is likely to become unpopular; and hence, from the unwillingness of judges and juries to convict for capital offences, and of governments to carry capital sentences into effect, uncertain. Whenever the infliction of capital punishments becomes uncertain, their efficacy ceases, and they ought to be mitigated. An uncertain punishment is not feared, and consequently the pain caused by its actual infliction is wasted. Capital punishments ought therefore to be denounced only for crimes which could not be effectually prevented by a secondary punishment, and for which they are actually inflicted with as much constancy as the necessary defects of judicial procedure will allow.

The writings on the subject of punishment, and particularly of capital punishment, are numerous. Beccaria's well known treatise first, with Voltaire's assistance, diffused more rational views on the subject throughout Europe; but it cannot be read with much profit at the present time. The best work on the subject is Bentham's *Théorie des Peines*, edited by Dumont. Some valuable remarks on the subject of punishment may likewise be found in the recent writings of Archbishop Whately and others respecting transportation.

PUPA. In entomology, this term is applied to the third stage of existence of an insect, the egg being the first stage, and the larva or caterpillar, the second. A caterpillar, from the time that it leaves the egg until it is full grown, frequently casts its skin; and the necessity for this change arises from the circumstance that the soft skin of the animal rather stretches than grows between the times of casting; and as the horny parts, such as the head, parts of the mouth, legs, &c., cannot stretch, they become out of proportion; and, unless they were changed for large parts, the insect could never attain its proper size.

There are certain times in which a caterpillar is comparatively torpid; cannot eat, and with difficulty moves. During this time a new set of parts are rapidly forming beneath the old ones (which prevents their being used); and when these are perfected, the old covering, or skin, including that of the head, legs—in fact, of all the external parts, and even the lining of the intestinal canal and of the breathing openings—is cast off. Previous to this shedding of the skin, as before stated, all the hard parts are proportionately small, and the soft skin is stretched to its utmost; but after the moult, the new skin is loose, and the horny parts are proportionately large. When the caterpillar has thus, by a series of moults, attained its full size, it again casts its skin; but instead of keeping the caterpillar form, we find the animal much changed in appearance: it has in fact assumed the pupa state. In this pupa we can trace most of the parts of the caterpillar with an addition of other parts (in a more or less rudimentary state) which are peculiar to the perfect insect. The pupa is at first soft (and is filled with a watery fluid); but, in many instances, the skin soon becomes hardened, as in the pupa, or chrysalis, state of the Lepidopterous insects.

'From the swathed appearance of most insects in this state' (say Messrs. Kirby and Spence), 'in which they do not badly resemble in miniature a child trussed up like a mummy in swaddling-clothes, according to the barbarous fashion once prevalent here, and still retained in many parts of the Continent, Linné has called it the pupa state, and an insect when under this form, a *pupa*. In this state most insects eat no food; are incapable of locomotion; but there are differences in the various orders which are worthy of attention. The most perfect transformation, perhaps, takes place in the Hymenopterous insects; that is to say, there is more difference between the larva and perfect or imago state of these insects, than in other tribes; and as one of the peculiar characteristics of the insect tribe consists in their transformation, this fact, in conjunction with others, would lead one to place that order at the head of the insect tribe. The larva of an Hymenopterous insect is a legless maggot, and has consequently very little power of locomotion: in the pupa state, all the parts are enclosed in a thin membrane; and although they are applied closely to each other, they are not glued, as it were, as in the case of the pupæ of Lepidopterous insects; neither does the thin skin which covers the Hymenopterous pupæ harden to that degree as we observe it in the insects just mentioned, owing probably to their being for the most part better protected from the inclemencies of the weather, partly by the situations in which they are placed, and partly by being enclosed in a silken cocoon spun by the larva immediately previous to its transformation. The pupæ of the Coleopterous insects resemble those just described: they constitute what Aristotle called *Nymphæ*, and are now most frequently termed *incomplete* pupæ.'

'Butterflies, moths, and some of the two-winged tribe,' say the authors before quoted, 'are, in their pupa state, also enclosed in a similar membranous envelope; but their legs, antennæ, and wings are closely folded over the breast and sides, and the whole body enclosed in a common case or covering of a more horny consistence, which admits a much less distinct view of the organs beneath it. As these pupæ are often tinged of a golden colour, they were called from this circumstance *chrysalides* by the Greeks, and *aureliæ* by the Romans, both of which terms are in some measure become Anglicized; and although not strictly applicable to ungilded pupæ, are now often given to those of all Lepidopterous insects. These by Linné are denominated *obtected* pupæ.'

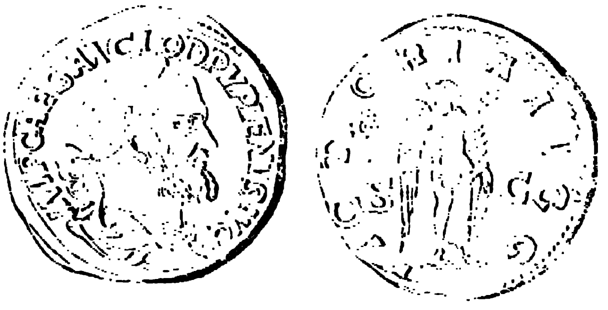
The differences however between the *obtected* pupæ and the *incomplete* pupæ are not so great as would appear from the passage just quoted; they are only differences of degree. We have reason to believe the parts are not all enclosed in one common integument, but that the legs, antennæ, and wings each have a sheath: that side which is not exposed differing only in being thinner. In the orders *Hemiptera*, *Orthoptera*, and many of the *Neuroptera*, the pupæ are active, and differ only from the larvæ in possessing rudimentary wings. In some cases the perfect insects of these orders have no wings, and it is difficult, if not impossible, to distinguish the stages:—Here there is an approach made towards the *Crustacea*, but in the true insects the skins are never shed after they have attained maturity, whereas in the *Crustacea* the integument is cast even after the species have the power of propagation. The necessity for moults is the same in both cases; the shell of the crab, like the integument of an insect, having no power of growth after its first formation.

It has been stated that insects immediately previous to their moult are inactive; but there is much difference in the duration of this state, and this difference appears in a measure proportionate to that which exists between the insect before and after the moult. The caterpillar of the butterfly or moth is a considerable time inactive before it changes into the pupa state, whereas when the change is not so great, the time in effecting that change is less.

To the various kinds of pupæ already mentioned may be added one other, termed by Linné the *coarctate* pupæ. These are peculiar to the insects belonging to the order Diptera. These pupæ are not, as in other instances, excluded from the skin of the larva, but remain concealed under it: the skin of the larva in fact forms a kind of protecting cocoon. Where the pupæ resemble the larva and perfect insect, except in possessing rudiments of wings, as in most of the *Orthoptera* and *Hemiptera*, they are termed by Linnæus *semi-complete* pupæ; and lastly, where the pupæ do not differ from the perfect insect, as in the lice tribe, they are called *complete* pupæ. These terms are however of but little use; there are in fact only two essential differences in the pupæ of insects, and they may be expressed by the terms *active* and *inactive*; the active pupæ being those which walk about. The terms given by Linnæus, and applied by Messrs. Kirby and Spence and other authors, to all the trifling modifications of pupæ, we think have a tendency to prevent generalizations by creating a prejudiced idea of differences greater than those which in reality exist. Besides this, the science is already overburthened with technicalities.

PUPA. (Conchology.) [HELIX, vol. xii., p. 106, 107, 110.]

PUPIE'NUS. CLODIUS PUPIENUS MAXIMUS, an officer of rank in the Roman army, was elected emperor by the senate conjointly with Balbinus, after the death of the two Gordians, in opposition to the usurper Maximinus, A.D. 240. After a reign of about a twelvemonth, he was killed, together with his colleague, in an insurrection of the Prætorians at Rome. Further details concerning these events are given under BALBINUS.



Coin of Pupienus.

British Museum. Actual Size.

PUPIL. [EYE.]

PUPIL, ARTIFICIAL. The operation of forming an artificial aperture in the iris is required in a variety of cases in which the passage of light through the natural pupil to the deeper seated parts of the eye is obstructed; and to meet the different exigencies of these several cases a variety of operations have been suggested, each of which in its turn deserves to be preferred. The chief of these are—1, the tearing away a portion of the iris from its attachment to the ciliary ligament [EYE], a method which is however now very rarely employed; 2, the making a simple incision through some part of the iris, by the retraction of whose edges an elliptical or circular aperture is produced; 3, the making a portion of the iris protrude through an aperture in the cornea, and cutting it off. In whatever way the operation be performed, it is necessary to make the aperture in the iris as large as possible, that when it contracts in the process of cicatrization, it may not be too small to permit the passage of a sufficient quantity of light for useful vision.

PUPI'VORA. In entomology this term is applied by Latreille to his second great section of hymenopterous insects—a section the species of which are distinguished by their having the abdomen attached to the thorax, in most cases, by a slender stalk, and not, as in the first section (*Securifera*), forming as it were a continuation of the thorax. The females are furnished with a slender bristle-like ovipositor, and in this respect they also differ from the greater portion of the *Securifera*.

The larvæ of the *Pupivora* have no feet, and most of them are parasitical. Latreille divides this section into two groups, the *Evaniales* and the *Ichneumonides*, distinguished chiefly by the insertion of the stalk or basal portion of the abdomen. In the *Evaniales* the stalk is attached to the thorax, and in most cases immediately under the scutellum: they have distinct nervures to the wings, and those of the upper pair form cellules; the antennæ are filiform, or setaceous, and composed either of thirteen or fourteen joints; the mandibles are toothed on the inner side; the maxillary palpi have six joints, and the labial four; the ovipositor is generally exserted, and composed of three slender pieces.

Dr. Leach regarded the present group as constituting a family, and applied to it the name *Evanidæ*; compared with the next section of the *Pupivora*, the present one is very limited in species. Mr. Stephens, in his 'Systematic Catalogue of British Insects,' only enumerates five species, and [illegible] constitute three genera, *Evania*, *Brachygaster*, and *Fœnus*.

In the *Ichneumonides* the abdomen has its origin between the two posterior legs; the nervures of the upper wings form cellules: the antennæ are generally filiform or setaceous, and composed of many joints (sixteen at least); the mandibles are in most cases destitute of denticulations on the inner side, and are bifid at the apex; the maxillary palpi are always distinct, and seldom have more than six joints. Of this group the species are exceedingly numerous. Mr. Stephens states that he possesses 800 British species of this family. The *Pupivora* appear to be destined to prevent other tribes of insects (particularly the *Lepidoptera*) from becoming numerous.

The *Ichneumonidæ* may be seen during the summer months in great numbers flying from plant to plant in search of the caterpillars which are suited to furnish the proper food and to rear their larvæ, each caterpillar apparently having its own peculiar parasite, or parasites, for sometimes several species of ichneumon attack the same larvæ. The female ichneumon, by means of her long bristle-like ovipositor, inserts her eggs into the body of the caterpillar in such a manner, and in such parts, that it does not destroy the life of the victim. In most cases these eggs are not hatched until the caterpillar has changed into a chrysalis; they then hatch, and the ichneumon larvæ feed upon the contents of the pupa case, enclose themselves in silken cocoons, and undergo their final transformations, to come forth in proper season, eating their way through the chrysalis case. Instances are not uncommon in which the eggs of the ichneumon hatch in the body of the living caterpillar, and, what is most remarkable, they do not destroy its life. It is not until the larvæ have quitted their abode in the caterpillar that it dies, having the cocoons of the ichneumon larvæ attached to its skin. The caterpillar so abundant on cabbages, and which is that of the common white butterfly, affords a familiar example of this nature. At certain times of the year numbers of those caterpillars may be seen on walls adjoining gardens: on these they usually attach themselves (in some sheltered situation) to undergo the transformation into the pupa state. One of these caterpillars will appear healthy, select a convenient situation, attach itself (as usual before the change into the pupa state) by means of a silken thread around its body, but instead of undergoing the transformation, we shall find it after a short time covered with an immense number of small yellowish silken cocoons spun by the larvæ of the ichneumons as they crawl from its body. These cocoons, which are about one-eighth of an inch in length, are attached to each other, and to the skin of the caterpillar, which then dies. The larvæ of some of the *Ichneumonidæ* themselves are infected with parasites.

For the characters of the various subdivisions of this extensive group of insects, and for descriptions of the species, the reader is referred to the 'Conspectus Generum et Familiarum Ichneumonum,' by J. L. C. Gravenhorst.

PURANAS. [Sanscrit Literature.]

PURBACH, GEORGE, so called from the name of his birth-place, Peurbach, a village on the confines of Bavaria and Austria, and about twenty-four miles west from Linz, was born in the year 1423. His family name appears to be unknown. Montucla informs us that he became a pupil of Gmunden, who taught astronomy in the university of Vienna: that he afterwards visited the principal seats of learning in Europe, in order to acquaint himself with those who cultivated astronomy; and that on his return he succeeded his master Gmunden, notwithstanding very strong solicitations to fix his residence at Bologna and Padua. He constructed many astronomical instruments, among which is an application of the plumb-line to a graduated circle; and he computed several trigonometrical tables, including a table of sines for every ten minutes of the quadrant, which his pupil Muller afterwards extended to each minute: but he is now chiefly remembered on account of the part he took in the translation and elucidation of the 'Almagest' of Ptolemy.

Printing, observes Delambre, had not then been applied to the diffusion of mathematical knowledge. The Greek manuscript of Ptolemy was then unknown in Europe, and the only works whence a knowledge of astronomy could be derived were two Latin versions of the 'Almagest' (translated from the Arabic), both of which were in many places incorrect, and more frequently altogether unintelligible; an imperfect Latin version of Albategnius; one of Alfragan; and a treatise on the sphere, by Sacrobosco, which last contained a few elementary notions relating to the phenomena of the diurnal motion and eclipses. Manuscripts were scarce, and those who could procure them were, for the most part, soon discouraged by the difficulties they encountered in their perusal of Ptolemy, and still more by the prolixity of his interminable calculations. It cannot therefore be a matter of surprise that those whose perseverance had in some measure surmounted these obstacles should enjoy a high reputation, and that their assistance should be eagerly sought after by others. Such was the case with Purbach. His ignorance of the Greek language would have precluded his reading the 'Almagest' in the original, had it been in his possession; but he had read the Latin translations of it, and after relieving them of their geometrical reasoning and tedious calculations, he endeavoured to explain the Ptolemaic system, not to those who wished to become astronomers, but to those who would be contented with a general notion of the mechanism of the phenomena and the arrangement of the heavenly bodies. The most difficult part was the theory of the planets, concerning which Sacrobosco was silent. Purbach made it the subject of a book, which was not published till 1488, twenty-seven years after his death, when it appeared at Venice appended to a quarto edition of Sacrobosco's treatise on the sphere, under the title of 'Theoriæ Novæ Planetarum.' This work, which may be looked upon as an introduction to Ptolemy, passed through many editions, accompanied by as many different commentaries; from which we may infer, says Delambre, that the work itself was not what it ought to have been, but that it served as the text-book to most of the professors of the day.

A faithful translation of the 'Almagest' was still a desideratum among astronomers. Bessarion, who first introduced into Europe the text of Ptolemy and that of his commentator Theon, had himself commenced a new version, but unable to proceed with it, in consequence of his numerous political missions, he addressed himself to Purbach, whom he persuaded to undertake the task. Our authority (Delambre), who does not say how Purbach qualified himself to translate from the Greek, adds, that when he had completed the earlier books, he died, confiding the revision and further prosecution of the work to his friend and pupil Muller. According to Montucla, Purbach was advised by Bessarion to acquaint himself with the language of Greece by revisiting Italy, where the literature of Greece was at that time much cultivated, and that his death took place suddenly when on the point of taking his departure from Vienna for that purpose. This work, which after all was but an abridgment of the original, was completed by Muller, under the title of 'Johannis de Monteregio et Georgii Purbachii Epitome in Cl. Ptolemæi Magnam Constructionem,' &c., and published by him at Basle in 1543. An analysis of its contents will be found in the 'Histoire de l'Astronomie du Moyen Age,' pp. 262-292; but any further notice of it belongs to the article **Regiomontanus**.

Purbach died at Vienna, April 8, 1461, in the thirty-eighth year of his age. His remains were interred in the cathedral of that city, where a Latin epitaph indicates his tomb.

His published works not already mentioned are: 1, 'Tabulæ Eclipsium,' fol., Vien., 1514, in which is given a list of his unedited manuscripts; 2, 'Elementa Arithmetices,' 4to., Viteb., 1536; 3, 'De Sinibus,' Nürnb., 1541; 4, 'De Quadrato Geometrico,' Nurnb., 1544.

(*Georgii Peurbachii et Joannis Mulleri Regiomontani Vita: Authore Petro Gassendo*, Hagæ, 1655, 4to.; Montucla, *Hist. des Math.*; *Biog. Univers.*, article 'Peurbach,' by Delambre; Hutton's *Dictionary*, &c.)

PURCELL, HENRY, the pride and boast of the English school of music, was born in the year 1658, in the city of Westminster, it is generally supposed. His father Henry, and also his uncle Thomas Purcell, were appointed gentlemen of the chapel-royal at the Restoration, and are named, in the archives of the heralds' college, among the persons who officiated at the coronation of Charles II. The young Henry lost his father when but six years of age, about which time he appears to have entered as one of the children of the chapel under Captain Cook, then master, to whom therefore it is rather more than probable he was indebted not only for his initiation in the principles of music, but for much of his knowledge of its practice, and of its theory as applicable to composition. It is true that on Dr. Blow's monumental tablet in Westminster Abbey, it is triumphantly recorded that he was 'master to the famous Mr. Henry Purcell;' and no doubt the youthful musician, when he quitted the chapel on his voice changing, received some instructions from Blow, a master then in high repute, and from whom a few lessons were enough to recommend to public notice a young man on his entrance into the world; but to Cook the credit is due for the right guidance of Purcell's inborn genius, and for its early cultivation. Sir John Hawkins says, 'it is certain that he was a scholar of Pelham Humphrey, who was Cook's successor,' but gives no authority for this, and assigns no reason for his belief. Humphrey became master of the children in 1672, when Purcell had attained his fourteenth year, who consequently could not have remained long, if at all, under the tuition of the new master: Cook therefore must not on such doubtful evidence be deprived of the praise to which he is entitled for his large share in the education of our great English composer. But, as Dr. Burney has well remarked, 'there is nothing more common than this *petit larceny* among musicians. If the first master has drudged eight or ten years with a pupil of genius, and it is thought necessary, in compliance with fancy or caprice, that he should receive a few lessons from a second, this last instantly arrogates to himself the whole honour both of the talents and cultivation of his new scholar, and the first and chief instructor is left to sing *sic vos non vobis*.'

Purcell was remarkable for precocity of talent, and seconded the liberality of nature by his zeal and diligence. While yet a boy-chorister he composed more than one anthem; and in 1676, though only eighteen years of age, was chosen to succeed Dr. Christopher Gibbons as organist of Westminster Abbey, an appointment of high professional rank. Six years after, in 1682, he became one of the organists of the royal chapel, and there, as well as at the Abbey, produced his numerous anthems, many of which appear in different collections, and nearly all of them have recently been published in one complete work. These were eagerly sought, almost as soon as written, for the use of the various cathedrals, and thus his fame quickly travelled to the remotest parts of England and Ireland. Had Purcell confined himself to church music only, he would have stood on very lofty ground as compared with either his predecessors or contemporaries, and his works would have been transmitted with honour to after-ages; but the greatness of his genius is most conspicuous in his compositions for the chamber and the stage. In these the vividness of his imagination and the fertility of his invention appear in all their affluence, because unrestrained by the character of the poetry to which he gave musical expression, and unincumbered by what is termed musical erudition, a kind of learning which time (even a century and a half ago) and a laudable feeling of veneration had rendered an almost necessary attribute of cathedral harmony. The versatility of his talent and the division of his labours between the church and the theatre, led his facetious friend Tom Brown, in his 'Letters from the Dead to the Living,' to say that musical men 'hang between the church and the playhouse, as Mahomet's tomb does between the two loadstones, and must equally incline to both, because by both are equally supported.'

Purcell's first essay in dramatic music, when only nineteen years of age, was his setting the songs, &c. in Nahum Tate's 'Dido and Æneas,' an operetta written for a boarding-school of celebrity. In this is the simple and beautiful duet, 'Fear no danger,' once sung everywhere and by everybody, but now almost forgotten. The music in Nat. Lee's 'Theodosius, or the Force of Love,' performed at the Duke's theatre, in 1690, was his first work for the public stage. In the same year he set new music to 'The Tempest,' as altered by Dryden, which is still heard with delight, and also the 'Prophetess, or Diocletian,' altered by Dryden and Betterton from Beaumont and Fletcher. In 1691 he composed the songs, &c. in Dryden's 'King Arthur,' among which are the inimitable frost-scene, the very original and lovely air, 'Fairest Isle,' and the charming duet, 'Two daughters of this aged stream are we.' In 1692 appeared Sir R. Howard's and Dryden's 'Indian Queen,' with Purcell's music. The fine incantation scene in this, 'Ye twice ten hundred deities,' is yet often heard in good concerts, but never in fashionable ones. The duet and chorus, 'To arms,' and the air, 'Britons, strike home!' in Dryden's alteration of 'Bonduca,' are national property—are our war-songs, always received with acclamations when we are engaged in or menaced by hostilities, and frequently performed during peace on account of their beauty, musically considered. These alone will suffice to carry Purcell's name to distant ages. His music in D'Urfey's 'Don Quixote' is remarkably appropriate and clever: the song, 'Genius of England,' has few rivals, and the cantata, 'Let the dreadful engines of eternal will,' sung in the character of the love-distracted Cardenio, is, with the exception of the latter part (now very wisely omitted in the performance), one of the composer's finest creations. He also wrote airs, overtures, and act-tunes for many dramas, among which may be mentioned Dryden and Lee's 'Œdipus,' 'Timon of Athens,' 'The Fairy Queen,' altered from 'A Midsummer-night's Dream,' and Dryden's 'Tyrannic Love, or the Royal Martyr.' [**Opera**, p. 442, col. 1.]

The three detached cantatas by Purcell are undeniable proofs of his fancy, energy, and deep feeling. It is sufficient to name 'Mad Bess,' 'Old Tom of Bedlam,' or 'Mad Tom' (the words by Mr. William Basse, Walton tells us, in his 'Angler'), and 'From rosie bowers,' written by Tom D'Urfey, but *not* originally sung in 'Don Quixote,' as Percy seems to think. So well known are these, so highly valued by true connoisseurs, and so much admired by all lovers of music, that one more word in their praise would be superfluous. Our limits will not allow us to enter into any account of, or even to name, his many single songs and duets. After the composer's death they were collected by his widow, and published in two folio volumes, under the title of 'Orpheus Britannicus,' the second and best edition of which is now very rare. His odes, glees, catches, and rounds are numerous, and several of them familiar to the admirers of vocal harmony. In 1683 he published twelve sonatas for two violins and a base. In the preface he says that 'he has faithfully endeavoured a just imitation of the most famed Italian masters, principally to bring the seriousness and gravity of that sort of music into vogue and reputation among our countrymen, whose humour 'tis time now should begin to loathe the levity and *balladry* of our neighbours.' Purcell's esteem for the Italian masters had been before confessed in the dedication of his 'Diocletian' to the duke of Somerset, wherein he modestly remarks, 'Poetry and painting have arrived to their perfection in our country: music is yet but in its nonage, a forward child, which gives hope of what it may be hereafter in England, when the masters of it shall find more encouragement. 'Tis now learning Italian, which is its best master, and studying a little of the French air to give it somewhat more of gayety and fashion. Thus being farther from the sun, we are of later growth than our neighbouring countries, and must be content to shake off our barbarity by degrees.' Here he does justice to the French school, by which he had certainly profited, though in a perfectly fair manner.

Two years after his decease his widow printed the overtures, act-tunes, &c. before mentioned, under the title of 'A Collection of Ayres composed for the Theatre, and on other occasions,' &c. They are in four parts, and continued in use in Dr. Burney's time, till superseded by Handel's concertos and other newer compositions.

We have above alluded to Purcell's compositions for the church, and as regards these must add a few remarks. His published anthems amount in number to upwards of fifty; and to these are to be added a *Te Deum* and *Jubilate* with orchestral accompaniments,—a complete Service, several hymns, motets, and sacred songs. Some of his anthems, especially those in Dr. Boyce's Collection, are still in use in our cathedral and other choirs, and never can be allowed to fall into neglect while the influential persons in those venerable establishments possess any musical discernment. His *Te Deum* and *Jubilate*, to which the epithet 'grand' is the usual prefix, is a work that has seldom if ever been spoken of but in terms of unqualified panegyric. That it evinces many traits of originality—that it displays a vast deal of scientific skill—that an easy, pleasing melody runs through portions of it—and that it has also the merit of being the first of the kind ever produced in this country, cannot be denied: but, on the other hand, there is in its general structure a want of suitable grandeur,—mainly arising from the frequent occurrence of mean passages of pointed, jerking notes in the vocal parts, that take from it much of the solemnity which the subject demands; and these, together with certain divisions that disconnect the words and obscure the sense, produce an effect not only undignified, but nearly bordering on the ridiculous. Besides these greater defects, there are in the work some others of less importance, such as a few conceits, some harsh notes, and occasional errors in accentuation and emphasis. The best excuse for the composer is, that most of the errors we have ventured to point out were common at the time they were committed. Still they are errors, and of magnitude, and should have kept within moderate bounds that warmth of feeling which has led to such unreserved encomiums on what, in our opinion, is by no means to be reckoned among the best of the composer's works.

Purcell died in November, 1695, of consumption, Hawkins surmises; and it is to be wished that this always industrious and sometimes over diligent historian had not snatched from the oblivion to which it ought to have been consigned, a 'tradition' that his death was occasioned by a cold caught in an inclement night, waiting for admittance into his house, Mrs. Purcell having 'given orders to his servants not to let him in after midnight.' We regret to say that this exceedingly improbable story has lately been revived, without the slightest attempt at proof, accompanied by vituperative expressions most injurious to the memory of one who, if we may judge from her language in the dedication to the *Orpheus Britannicus*, was an attached, faithful wife, and incapable of the cruelty alleged against her. Purcell's habits, Hawkins states, were of the most convivial kind, and led him too frequently into the society of 'the witty Tom Brown,' together with other persons of irregular lives; and thus were, most likely, sown the seeds of a disease which at so early a period terminated a life of such inestimable value.

The remains of this great musician lie in the north transept of Westminster Abbey: on a pillar near the spot is a tablet, placed there by the Lady Elizabeth Howard, on which is the subjoined inscription, commonly attributed to Dryden:—

'Here lies
HENRY PURCELL, Esq.,
who left this life,
and is gone to that blessed place
where only his harmony can be exceeded.
Obiit 21mo. die Novembris,
Anno ætatis suæ 37mo.,
Annoq. Domini, 1695.'

On the stone over his grave was a Latin epitaph, now entirely effaced. The original and a translation are both given by Hawkins and Burney. Among the works of Dryden is an epitaph on the death of his friend Purcell, but it cannot be viewed as one of the happiest of the great poet's efforts. Sheffield, Duke of Buckingham, wrote an ode on the same occasion, in which are some noble thoughts concerning the desire of posthumous fame. It concludes with the following praise of the art in which our British composer signalised himself:—

'Music exalts man's nature, and inspires
High elevated thoughts, or gentle kind desires.'

We shall conclude this notice by repeating the substance of some remarks made by us elsewhere a few years ago. Purcell, take him for all in all, is the greatest musical genius this country ever produced; and our deliberate opinion is, that, from the earliest period in the history of the art, down to the time of his death, Europe would in vain be searched to find his equal as a composer of secular music. That he was to some extent indebted to Lulli will hardly be denied; but that he far surpassed what, perhaps in compliment to our second Charles, and to the taste of the time, he occasionally took as his model, every impartial critic must admit. If too his cantatas be compared with compositions in a degree similar, by Alessandro Scarlatti, which have been so highly praised, and so long were vaunted, the vast superiority of the English musician, whether as relates to air, to harmony, to variety of expression, or to beauty of effect, will never be disputed by unbiassed judges. He certainly was not wholly guiltless of the faults of the age in which he lived; or, perhaps, was obliged sometimes to yield his better judgment to the tyrannical demands of custom or of fashion; yet some of his ecclesiastical and most of his secular music, written under the influence of his own feeling, and uncontrolled by the necessity of submitting to the taste of the great and small vulgar, is so rich in melody, so expressive of the depth and energy of true passion, that all who understand the English tongue, who have acquired some knowledge of the language of music, and have no governing predilection for any particular school, confess his power, and admit the originality and vigour of his genius.

PURCHAS, SAMUEL, was born at Thaxted in Essex, in 1577. He was educated at Cambridge, and though Wood says that he could not ascertain at what college or hall, it appears from his own testimony that he was a member of St. John's College; for in speaking of this college he says, 'Where also the author first conceived with this travelling genius, whereof without travelling he hath travelled ever since.' (*Pilgrimmes*, part iii.; *Dedication to Lord Keeper Williams.*)

In 1604 Purchas was instituted to the vicarage of Eastwood in Essex, but he soon left this cure to a brother, and went to live in London for the sake of greater advantages in preparing and printing the collection of travels which he had begun to make. In July, 1615, he was incorporated bachelor of divinity at Oxford, as he stood at Cambridge, having previously been collated by the favour of Dr. John King, bishop of London, to the rectory of St. Martin's Ludgate, in London. He also became chaplain to archbishop Abbot, but he never obtained higher preferment. By the publication of his books he brought himself into debt, and it was reported that he died in prison; but Wood affirms that he died in his own house a little while after the king (Charles I.) had promised him a deanery, about 1628, aged fifty-one.

The works of this author are the following:—1, 'Purchas his Pilgrimage, or Relations of the World, and the Religions observed in all Ages, and Places discovered, from the Creation unto this present,' 1 vol. fol., 1613, 1614, 1617, 1626. The materials of this work he borrowed, as he says, of above thirteen hundred authors of one or other kind, in he know not how many hundredths of their epistles, treatises, and relations. (*Dedication to Archbishop Abbot*, prefixed to fourth edition.) 2, 'Purchas his Pilgrimmes,' in four parts or vols., fol., 1625, each volume containing five books. The difference between these volumes and the former publication may be best shown in his own words: 'These brethren holding much resemblance in name, nature, and feature, yet differ in both the object and subject. This (the 'Pilgrimage') being mine own in matter, though borrowed, and in form of words and method; whereas my Pilgrims are the authors themselves, acting their own parts in their own words, only furnished by me with such necessaries as that stage further required, and ordered according to my rules.' (*Dedication*, as above.) 3, 'Microcosmus, or the History of Man,' 8vo., 1619; 4, 'The King's Tower, and triumphant Arch of London,' 8vo., 1623; 5, 'A Funeral Sermon on Psalm xxxix. 5,' 8vo., 1619.

Of these five publications, the first two are best known, though they are now very scarce. They are curious, and in some respects valuable, and are probably the first works of the kind in our language. The dedications and prefaces particularly show that Purchas was an honest, a benevolent, and a pious man, and that he was of unwearied industry in performing his clerical duties, as well as in preparing his books for publication. He is described by a foreign writer, quoted by Wood, as 'an Englishman admirably skilled in languages, and human and divine arts, a very great philosopher, historian, and theologian, a faithful priest of his own church, very widely known for his many excellent writings, and especially for his large volumes pertaining to the East and West Indies.'

(Wood's *Fasti Oxonienses*; *Biog. Brit.*; the latter contains a good description of Purchas's two principal works.)

PURCHASE. [PROPERTY.]

PURGATION. [ORDEAL.]

PURGATORY ('a place of expiation,' from the Latin verb *purgare*, 'to cleanse') is the name given by Roman Catholics to an intermediate state of souls after death, and before the final judgment, during which they are supposed to expiate by certain punishments the guilt which they have incurred through life. Roman Catholic divines teach that it is only the souls of those who die in a state of repentance and in the communion of the church that are admitted into purgatory; those who die impenitent, or in a state of unbelief, are doomed to everlasting punishment. As for the duration of the term of expiation in purgatory, that is a matter which rests with divine justice, and varies according to the guilt of the parties, but Roman Catholics believe that the prayers of the living and other pious works may serve to shorten the term of souls in purgatory. This has given rise to the doctrine of indulgences, with which that of purgatory is closely connected. [INDULGENCE.] The Protestant and other churches which dissent from the church of Rome do not believe in purgatory. No mention of purgatory appears before the time of Augustin, who in some of his works speaks of it in terms not very explicit. The doctrine is said to have been first inculcated as a matter of belief by Gregory the Great, at the end of the sixth century. In the Council of Ferrara, A.D. 1438, which effected a temporary reconciliation between the Greek and Roman churches, the question of purgatory was discussed at length. Mark of Ephesus, on the part of the Greeks, stated the belief of his church in this respect to be that souls were sent after death to a place of darkness and mourning, but not of fire, where they remained for a season in affliction and deprived of the light of God. He admitted that alms and other pious works might shorten or mitigate their penance, but he held that even the saints or souls free from stain would not be admitted to perfect beatitude till the resurrection of their bodies at the final judgment.

PURITANS, a name first given in the reign of Queen Elizabeth to such clergymen of the church of England as declined to subscribe to its liturgy, ceremonies, and discipline, according to the requirements of the bishops in their respective dioceses. Fuller assigns the origin of this name to the year 1564, and Strype to the year 1569; but it seems not very easy to ascertain the exact date when any such name might have been first used. The clergymen so called were advocates for a further reformation than the existing authorities deemed it proper to sanction; they desired a form of worship more simple and *pure* than they believed that to be of the church as then established. They were called Puritans probably out of derision, and the name was shortly applied to the laity as well as to the clergy. This name in the time of Fuller evidently savoured more of contempt than it does at present; for he speaks of it as 'the odious name of Puritans; a name which in this notion first began in this year (1564); and the grief had not been great, if it had ended in the same. . . . We will therefore decline the word to prevent exception; which, if casually slipping from our pen, the reader knoweth that only non-conformists are thereby intended.' (*Church Hist. of Britain*, b. ix., p. 76, ed. 1655.) The Puritans were by other writers of the seventeenth century generally called non-conformists, a name first applied to men who objected to the clerical vestments about 1550. 'For now,' says Fuller, 'non-conformity in the days of King Edward was conceived; which afterwards, in the reign of Queen Mary (but beyond sea at Frankfort), was born; which, in the reign of Elizabeth, was nursed and weaned; which, under King James, grew up a young youth, or tall stripling; but, towards the end of King Charles's reign, shot up to the full strength and stature of a man, able not only to cope with, but conquer the hierarchy, its adversary.' (*Ibid.*, b. vii., sect. i., 23.) The reader is referred, for a general history of the Puritans, to the work of Neal, on the one hand, and, on the other hand, to the works of Strype and Collier. On the political influence exercised by the Puritans, Hallam's *Constitutional History of England* may be consulted. [DISSENTERS; NON-CONFORMISTS.]

PU'RPURA. (Conchology.) [ENTOMOSTOMATA, vol. ix., p. 458.]

PURPURIC ACID. This substance was first prepared and described by Dr. Prout. When uric acid [URIC ACID] is gently headed with nitric acid diluted with about six times its weight of water, it dissolves with effervescence, and decomposition of the nitric acid. If the solution be evaporated with a gentle heat, it becomes, on drying, of a fine red colour, which disappears when it is dissolved in water. When this solution is saturated with ammonia, the red colour is restored, and granular crystals of purpurate of ammonia, of a deep red colour, are deposited; when these are decomposed by hydrochloric acid, a yellow powder separates, which is purpuric acid; if however the salt, previously to decomposition, be treated with potash, then the ammonia is expelled, and sulphuric acid added separates colourless purpuric acid.

The properties of this acid are, that it is so little soluble in water, that one part requires 10,000 even of boiling water for solution; the solution is sometimes colourless and at other times pale red, or yellow, but no cause has been assigned for these variations. Purpuric acid is inodorous and insipid; it reddens litmus paper; neither alcohol nor æther dissolves it. It does not fuse when heated, but becomes red; when heated in the air, it burns without yielding any peculiar odour. When decomposed in a retort, it yields carbonate of ammonia, hydrocyanic acid, a small quantity of empyreumatic oil, and a pulverulent charcoal. Nitric acid dissolves it with effervescence, and converts it into oxalic acid. It dissolves in concentrated sulphuric acid, and water precipitates it from the solution. It is also soluble in boiling concentrated acetic acid; but neither citric, oxalic, nor tartaric acid dissolves it. Authors differ extremely as to the composition of this acid; the variation is indeed so great as scarcely to admit of the supposition that they can have operated on the same substance as analyzed by Dr. Prout. It has indeed been lately asserted by Fritzche, that the substance obtained by the action of acids on purpurates is not purpuric acid, but is principally *murexane* resulting from its decomposition.

We shall state the results of the analyses of Dr. Prout (1), Fritzche (2), and Kodweis (3), premising that we have seen the last stated only in symbols, and the results are adapted to the numbers employed in this work:—

(1)

Two equivalents of hydrogen .	4·54
Two equivalents of carbon .	27·27
Two equivalents of oxygen .	36·36
One equivalent of azote .	31·81
	99·98

(2)

Four equivalents of hydrogen .	1·6
Sixteen equivalents of carbon .	38·4
Ten equivalents of oxygen .	32·0
Five equivalents of azote .	28·0
	100·0

(3)

Six equivalents of hydrogen .	2·04
Eighteen equivalents of carbon	37·07
Twelve equivalents of oxygen	32·65
Six equivalents of azote .	28·24
	100·00

The salts of purpuric acid are termed purpurates; we shall state the properties of a few of these compounds, copied chiefly from Dr. Prout. This acid combines with the alkalis, alkaline earths, and metallic oxides, and is capable, with the assistance of heat, of decomposing the alkaline carbonates with effervescence.

Purpurate of Ammonia.—This salt is obtained by saturating the acid with the alkali; it crystallizes in quadrangular prisms, which, when viewed by transmitted light, are transparent, and of a deep garnet-red colour; but by reflected light, their two broadest opposite faces appear of a brilliant green, while their other two opposite faces appear of a dull reddish-brown colour, or, if the light be very strong, slightly green. This salt is soluble in about 1500 parts of water at 60°, but in boiling water is much more soluble; the solution is of a beautiful deep carmine or rose-red colour; it is inodorous, but has a slightly sweetish taste. Alcohol and æther dissolve this salt very slightly if at all. It does not appear to have been analyzed.

Purpurate of Potash.—According to Fritzche, this is best obtained by decomposing a boiling solution of purpurate of ammonia by means of excess of nitrate of potash. This purpurate consists of very small reddish-brown crystals; it may however be obtained in large crystals, which have the colour and lustre of the ammoniacal salt. It is difficultly soluble in water, and much less so in saline solutions, and hence the advantage of using excess of nitre in preparing it. By Fritzche's experiments it appears to be a neutral salt.

Purpurate of Soda is of a dark brick-red colour, and may be obtained in crystals; it is much less soluble in water than the potash salt, requiring 3000 times its weight for solution, or even more at 60°. The purpurates of lime, barytes, and strontia are still less soluble than those above described; they are of a deep greenish colour, but when dissolved in water they impart a purple colour to it. In the opinion of Berzelius there are two salts of lime; one of which is a bulky red crystalline powder, and the other, which is greenish-black, appears to be a subsalt. The purpurate of magnesia is very soluble.

When purpurate of ammonia is added to a solution of metallic salts, the effects produced are as follows:—Cobalt, a granular reddish precipitate; zinc, a fine yellow; tin, a scarlet precipitate; mercury, protosalts, a purple precipitate; persalts, a pale rose precipitate; silver, a deep purple one; the salts of lead, iron, nickel, and copper, the chlorides of gold and platina, alter their colour by the addition of purpurate of ammonia, but are not precipitated by it.

With respect to the characteristic properties of the purpuric acid, Dr. Prout is of opinion that it may be readily distinguished from all other substances by the beautiful colours exhibited by its alkaline and earthy salts, independently of its other properties, which are very peculiar. He further observes that the well known pink sediment which generally appears in the urine of those labouring under febrile affections, appears to owe its colour to the purpurate of ammonia, and perhaps occasionally to the purpurate of soda; and he has suggested that some of the purpurates, especially that of lime, might be used as a paint, and that others might be employed in dyeing.

PURPURI'FERA, Lamarck's name for a family of mollusks belonging to the section of his order *Trachelipoda*. The family consists of the genera *Cassidaria*, *Cassis*, *Ricinula*, *Purpura*, *Monoceros*, *Concholepas*, *Harpa*, *Dolium*, *Buccinum*, *Eburna*, and *Terebra*. The whole of these genera are treated of in the article ENTOMOSTOMATA.

PURSER. [NAVY, pp. 121, 122.]

PURSLANE. There are two varieties of the garden purslane, the *Green* and the *Golden* (the Portulaca sativa and oleracea of botanists), but these cannot be considered truly distinct species, for seeds from the same individual produce occasionally both green and golden-leaved plants. They are annuals, with fleshy succulent leaves, probably indigenous to the East Indies, but now apparently wild in the South of Europe and South America.

Purslane was formerly more used than at present, at least in this country, in salads, as a pot-herb, in pickles, and for garnishing. It is considered to be very cooling, and hence in warm countries it is more esteemed. Any light soil will suit it; being succulent, it will even thrive in sandy soil. It requires to be sown in April, or when the danger of frost is over, and covered very slightly with a little fine mould. Successional sowings may be made in May, June, and July.

PURVEYANCE (*purveance*, a providing), a prerogative formerly enjoyed by the king through the means of officers called purveyors, of purchasing provisions and other necessaries for the use of the royal household, and of employing horses and carriages in his service, in preference to all other persons, and without the consent of the owners. A privilege of the same nature was also exercised by many of the great lords. The parties whose property was thus seized were entitled to a recompense; but what they received was so inadequate, and so many abuses were committed under the pretext of purveyance, that it seems to have been always considered a most intolerable grievance. About forty statutes were passed upon the subject, many of them, like all the important early statutes, being a re-enactment of those preceding. Some of the most stringent occur in the 36th year of Edward III. The parliament of that year, which is said to have been held 'for the honour and pleasure of God, and the amendment of the outrageous grievances and oppressions done to the people, and the relief of their estate,' after a general confirmation of former statutes, immediately proceeds to enact five statutes on the subject of purveyance. These statutes confine the exercise of it to the king and queen, and provide that for the future 'the heinous name of purveyor shall be changed into that of buyer:' they forbid the use of force or menaces, and direct that where purveyors cannot agree upon the price, an appraisement shall be made, &c. &c. The provisions of these statutes are very full and satisfactory, but they appear to have wholly failed in their operation. Other statutes were passed, but without effect. Several of the charges against Wolsey were the exercise of purveyance on his own behalf. (4 *Inst.* 93.) In the time of Elizabeth, two attempts were made in the same year by the Commons to regulate the abuses of purveyance. The queen was extremely indignant at this, and desired the commons not to interfere with her prerogative. In the early years of her reign, Elizabeth seems to have employed this prerogative for the purpose of victualling her navy. She afterwards revoked the warrants issued for that purpose, and designed likewise to have taken away the commissions relating to the provision for her own household, some counties having agreed, some time after, to furnish it at a certain rate, to get rid of the collectors—a kind of vermin which the Queen called *harpies*. During the first parliament of James I., Bacon, on presenting a petition to the king, delivered his famous speech against purveyors, which forms a sort of compendium of the heavy charges made against them. Several negotiations took place in that reign for the purchase of the prerogative of purveyance, but nothing was done. Under the Commonwealth it fell into disuse. Purveyance was not formally abolished till after the Restoration. By the 12 Ch. II., c. 24, this branch of the prerogative was surrendered by the king, who received in lieu of it a certain amount payable on exciseable liquors. Probably in the earlier periods of our history the existence of purveyance was almost necessary for the support of the royal household, especially during the progresses which were then so frequent. This seems almost a necessary inference from its continuance in spite of so many attempts to suppress it. Even after its final abolition by the statute of Charles II. several temporary statutes were passed, in that and the succeeding reign, for its partial revival on the occasion of royal progresses. On behalf of the navy and ordnance, a statute to that effect occurs as late as 11 and 12 Will. 3. (Camden, 388; Bacon's *Works*, vol. vi., p. 3, Montagu's edit.; Hume's *Hist.*; 1 Bl. *Com.*, 287; 3 *Inst.*, 82; 4 *Inst.*, 273.)

PUS. [ABSCESS; INFLAMMATION.]

PUSHKIN, ALEXANDER SERGEIVITCH, called by some the Russian Byron, and certainly the most distinguished poet of Russia in the present century, was born at St. Petersburg, May 26th (June 7th), 1799, and was educated in the Imperial Lyceum at Tzorskoe-Selo, which he quitted in 1817. While at that seminary he appears to have displayed more of natural quickness than of application, for though he made very little progress in his studies, he had even then begun to write poetry. On quitting the Lyceum, he began to exercise his pen with more of enthusiasm than of discretion in favour of liberalism; and although his first productions of the kind were circulated only in manuscript, his opinions became known, and he was represented to the government as the advocate of republican opinions. This occasioned his being sent into a kind of nominal banishment by the emperor Alexander in 1820, being compelled to accept some subordinate situation under the governor-general of Odessa. Perhaps Siberia would have been the place of his destination, had not his 'Ruslan and Liudmila' just then appeared, and been warmly received by the public. Of this legendary poem, in six cantos, which carries us back to the half-fabulous time of Vladimir, the Russian Charlemagne, a tolerably full account is given in an article on Russian literature in the second volume of the

'Foreign Review,' where it is said, 'Such is a brief outline of this romance, which is related with a grace and felicity that would do credit to the author of the "Bridal of Triermain."' A translation of an episode from the first canto may also be found in St. Maure's 'Anthologie Russe.'

The success of this, his first production of any length, did not however induce Pushkin to cultivate this kind of epic, if we may so term it, for he thenceforth abandoned it altogether, and adopted in his subsequent poetical narratives a looser and more lyrical form, in which, taking for his subject some single incident or brief and detached historical episode, he renders it a vehicle for the delineation of character, the expression of impassioned sentiment and feelings, and the portraiture of local manners and scenery. His earliest production of this class, his 'Plennik Kavkaskoi, or Prisoner of the Caucasus' (1822), is a mere sketch, most meagre indeed in its outline, relating no more than the escape of a young Russian captive from a horde of wild Tcherkassians, through the assistance of a Tcherkassian maiden; but it is vigorously touched, the images are as poetical as they are distinct, and the style is eminently graphic, though perfectly simple, and without any of that common-place frippery of fine words and phrases which are so frequently employed to conceal the inanity of a writer's ideas. This poem was translated into German almost immediately after its appearance.

To the 'Plennik' succeeded his 'Fountain of Bakhtchisarai' (1824), a production of much superior interest to the former, and in which the characters of Zarema and Maria, the former of whom has not a few traits in common with Byron's 'Gulnare,' are strikingly contrasted. For the manuscript of this poem, which consists of only six hundred lines, the author obtained 3000 rubles—a degree of remuneration then almost unprecedented. His reputation was now fixed, and the public impatiently waited for other productions of his muse. But he allowed an interval of nearly three years to elapse (1824-7) between writing his 'Tzigani' ('The Gypsies') and its being printed; and of his 'Evgenii, or Eugenius Onægin,' though the first chapter or canto appeared in 1825, the sixth was not printed till 1828. The 'Tzigani' had indeed been extensively circulated in manuscript previously to its issuing from the press, and in that form had acquired a celebrity that was no doubt enhanced by the kind of mystery attending it. It is a half-narrative, half-dramatic composition, constructed out of exceedingly slight materials, and gives a picture of the life of the gypsy tribes in Bessarabia, one evidently coloured after nature, but not calculated to render any one enamoured with the simplicity of that nomadic race. The 'Onægin,' avowedly a production akin to Byron's 'Beppo,' is a sort of novel in verse, descriptive of Russian life and manners in the capital and the provinces, and it is generally understood that the hero of it, whose name it bears, was intended by Pushkin for a poetical portrait of himself.

In 1829 appeared almost the last and also the best of his narrative poems, namely that entitled 'Pultava,' the hero of which is the same person as Byron's 'Mazeppa,' but here exhibited under a very different aspect—not as the blooming page, but as the Hetman of the Kozacks, who, notwithstanding his well-matured years, inspires a maiden, whom he has carried off from her parents, with an ardent attachment. An analysis of this poem, together with spirited translations of one or two scenes from it, will be found in the ninth volume of the 'Foreign Quarterly;' and the same article also contains some account of the 'Fountain of Bakhtchisarai' and the 'Tzigani.' The extracts there introduced are the more interesting, as not a single specimen of Pushkin occurs in Bowring's 'Russian Anthology,' that work having been published before Pushkin had risen into celebrity.

His dramatic poem of 'Boris Godunov,' produced about this period, is one of the most interesting of all his productions, in which, while historical fidelity as to the principal events is strictly observed, the poetical element prevails both in the language and the characters and situations; besides which merits, this piece possesses no small attraction as a masterly picture of national manners and feelings, replete with force and truth. After this, Pushkin nearly abandoned poetry altogether, and applied himself to prose composition, having been not only recalled from exile, but taken into favour by the emperor Nicholas, who appointed him historiographer, with a pension of 6000 rubles. This change in his fortunes was—if it did not occasion—accompanied by no less striking a change in his opinions, which, after being on the side of liberalism, settled into the contrary extreme. On the other hand, his popularity in the literary world began to decline; at all events, it rather abated than increased, for during the last seven or eight years of his life, his pen was almost inactive, the chief thing he produced in that time being a history—not of Peter the Great, as was expected—but of the rebel Pugatchev. His other productions during that interval amount to no more than a few tales and essays, and his articles in the 'Sovremennik, or Contemporary,' a literary quarterly miscellany, projected by him in 1836, and afterwards continued for the benefit of his family. Several of his posthumous papers, including the 'History of the Iron Mask,' 'Memoirs of Moreau de Brasse,' and fragments of various unfinished tales, romances, &c., have since appeared in that publication, which also contains a circumstantial narrative of his last moments, by one of his friends. His death was in consequence of a wound received in a duel with an officer; and after lingering two days, at times in excessive agony, he expired at St. Petersburg, January 29th (February 10th), 1837, in his thirty-eighth year. Besides paying his debts and bestowing a pension of several thousand rubles upon the poet's widow and family, the emperor commanded a splendid edition of all his works to be published at his own expense.

PUSTULIPORA. [MILLEPORIDÆ.]

PUTCHUK is the name by which a fragrant root is designated in the price-currents of Calcutta and Bombay, whence it is exported to Canton, being highly esteemed by the Chinese as an incense. From the places of export this would appear to be a product of India, but neither the plant which yields it nor the place where it grows has been discovered until very recently. The discovery is interesting, as the Putchuk is a substance which was known to the antients. Dr. Royle, while in the north-western provinces of India, obtained a root which formed a considerable article of commerce, and which was said to be brought from still farther north, that is, from Lahore. It was warm and aromatic in taste, fragrant in odour, and frequently called *orris* (Iris)-*root* by Europeans in India, though by the natives in northern India it is called *kooth*. On comparing specimens of kooth which he obtained in northern India with what was called *putchuk* in Calcutta, he found that they were identical, and he was subsequently informed by Mr. Beckett, who was long settled as a merchant in northern India, that what the latter purchased from Umritseer under the name of kooth, he sold in Calcutta by that of putchuk, so that there can be no doubt of the identity of the two substances; but all that had been ascertained with respect to the place where it was produced, was that it seemed to be to the north of the Sutledge.

Kooth, being used in India as a medicine, as well as exported to China, is described in the Persian works on Materia Medica in use in that country, and has assigned to it *kust* as the Arabic, *kooshta* as the Syriac, and *koostus* as the Greek name. Three kinds are described. Dr. Royle states that he was only able to meet with two kinds in India, one called *koost-hindee*, and the other *koost-arabee* these evidently refer to two of the three kinds of Costus described by Dioscorides as the Arabian, Indian, and Syriac. (*Illust. Himal. Bot.*, p. 360.) There can be little doubt therefore that the kooth or putchuk is one of the kinds of costus of the antients, which was highly esteemed by them, and formed an ingredient in their most famous compound alexipharmic confections, such as the Theriaca and the Mithridatium. It was also highly esteemed by them as an incense, as, in the line of Propertius, 'Ure puer costum Assyrium redolentibus aris;' and is mentioned by Horace as 'Achaemenium costum' (*Od.*, iii. 1).

The identity of *kooth* and *costus* was however long ago ascertained, though not generally known, as is evident in the following passage from Garcias ab Horto, in Clusius (*Exot.*, lib. x.), 'Est ergo Costus dictus Arabibus *Cost* aut Cast; in Malacca, ubi ejus plurimus est usus, *Pucho*, et inde vehitur in Sinarum regionem.' In MacCulloch's 'Commercial Dictionary,' Putchook is described as 'the root of a plant growing in Sinde. When burned, it yields a fine smell. The Chinese beat it into a fine powder, which they burn as incense in the temples of their gods.' Of the Putchuk 6597¾ bazar maunds, of the value of 99,903 rupees, were exported from Calcutta in the year 1837-38.

On Dr. Falconer's proceeding on his journey to Cashmere, Dr. Royle requested him to make inquiries respecting this substance, and he discovered that it was exported from the valley in large quantities to the Punjab, whence it finds its way to Bombay and Calcutta: and that it is sold in China at an advance of about three thousand per cent. on the price at which it is gathered in Cashmere. Dr. Falconer subsequently found it growing in great abundance all round the elevated summits of Cashmere. From the plants with which it is associated, and the circumstances under which the Koot grows, being one of the Compositæ, or Thistle tribe, with feathered seed, of which when once established the dissemination becomes easy, Dr. Falconer has no hesitation in thinking that it could be produced to an unlimited extent, of the best quality, in the Himalayas at elevations of from 7500 to 9000 feet above the sea, and that the Choor Mountain alone might be brought in a few years to produce thousands of maunds of it. Preparatory to diffusing the Koot or Costus, he has introduced it into the Himalayan nursery attached to the Saharumpore botanic garden.

Finding that it belongs to a new genus, he has named it Aucklandia, in honour of George earl Auckland, Governor-General of India, 'as a distinction well merited by his lordship's services in the cause of Indian botany.' (Royle, *On the Productive Resources of India.*)

PU'TEOLI. [POZZUOLO.]

PUTNEY. [SURREY.]

PUTRANJI'VA, an Indian genus referred by Dr. Roxburgh to Nageia, but which has been separated by Dr. Wallich under the above name, which is a Sanscrit compound, consisting of the words 'pootra,' *a son*, and 'jeeva,' *life*, in consequence of the seeds being strung by parents round the necks of children, under the supposition that they will preserve them in health. They are sold in bazaars throughout India for this purpose. P. Roxburghii, the only species known, forms a large timber-tree, with an erect straight trunk, and a white close-grained very hard wood. The head is large and shady, composed of numerous spreading branches, with shining dark-green leaves arranged on two sides of the branchlets. The flowers are diœcious, the male ones crowded together; the perianth small, calyx-like, four- to five-leaved; corol none; stamens three; filaments thread-like, all or only two united together, and the third free. The female flowers solitary in the axils of the leaves, with long footstalks; perianth five-leaved; ovary ovate, oblong, three-celled; cells two-seeded; styles three, filiform; stigmas crescent-shaped and toothed; drupe one-seeded. Young plants of this tree have been cultivated in moist stoves in this country. The genus has been referred to the natural family of Myricaceæ, but is considered by Endlicher as more nearly allied to the Antidesmeæ.

PUTREFACTION. [DECOMPOSITION; FERMENTATION: INTERMENT.]

PU'TSCHIUS, ELIAS, was born at Antwerp in 1580. He became early distinguished as a scholar, and at the age of twenty-one he published an edition of Sallust with fragments and notes. Four years afterwards he published the work by which he is chiefly known, 'Antient Authors of Latin Grammar,' small folio, Hanau, 1605. These authors are thirty-three in number, of whom several were never before printed, and the rest were so much corrected that they might seem, as he says in the title-page, to be then published for the first time. This work is dedicated to Joseph Scaliger, and it appears probable, from the character of the dedication, that Putschius had been a pupil of Scaliger. Three indexes are appended; the first of authors, the second of Greek words, and the third, which is most copious, of things and words in general. This collection of antient grammarians is of great value to all who are desirous of gaining a critical knowledge of the Latin language, and it also conveys indirectly many aids to the student of the Greek. Putschius died at Stade, March 9, 1606, in his 26th year. (Fabricius's *Bibliotheca Latina* contains an ample account of the treatises collected by Putschius.)

PUTTY, the useful cement used by glaziers for fastening the glass in the frames of windows, is composed of linseed-oil and whiting. The whiting should be well dried, and then pounded and sifted till it becomes a fine powder and is quite free from grit. The whiting, a little warm, should be gradually added to the oil, and well mixed by means of a piece of stick or a spatula. When it is sufficiently stiff, it should be well worked with the hand on a table, and afterwards beaten on a stone with a wooden mallet, till it becomes a soft, smooth, tenacious mass. Putty by exposure to the air gradually hardens till it becomes almost like stone. A ball of putty, when left some days, becomes somewhat hard, but may be easily softened by beating.

PUY, LE, a town in France, capital of the department of Haute Loire, and the seat of a bishopric, situated on the south bank of the Borne, one of the early feeders of the Loire; 273 miles in a direct line south by east of Paris, or 304 miles by the road through Nevers, Moulins, and Clermont-Ferrand; in 45° 2′ N. lat. and 3° 52′ E. long.

Le Puy originated in the eighth century, from the resort of pilgrims occasioned, it is thought, by the sanctity of an image of the Virgin. The town, thus formed, took its name from the old Aquitanian word *Puech*, or *Puich*, 'mountain,' a name descriptive of its situation on the slope of Mount Anis crowned with the volcanic rock Corneille. The site of the town, which lies among the high lands of central France, is about 2000 feet above the level of the sea. In the middle ages, Le Puy was the capital of Le Velay, and the place of assembly for the states of that province. In the religious wars of the sixteenth century, it suffered severely, and was one of the last places which held out in France against Henri IV.

Owing to its situation, the town presents a picturesque appearance; but the streets are ill laid out, steep, narrow, dirty, and paved with lava; the houses are of lava, and are for the most part old and ill built. The cathedral, built in the tenth century, the most striking public edifice in the town, is not worthy of the high encomiums which have been bestowed upon it. Its architecture is heavy and inelegant; and it is in a great degree hidden by the adjacent buildings of the hospital and episcopal palace. Even its lofty situation loses part of its effect by the superior elevation of the summit of the rock Corneille, on which summit are the ruins of the antient castle. The front of the cathedral is approached by an immense staircase of more than a hundred steps. The interior contains a good picture of the Massacre of the Innocents, an elaborate carving of the Martyrdom of St. Andrew in relief on wood, and the reputed miraculous image of the Virgin, to which it is supposed the town owes its origin. The material, cedar wood, covered with bands of fine linen firmly glued on the wood in the manner of an Egyptian mummy, and painted in distemper, and its posture, seated like some of the Egyptian divinities, indicate an Eastern origin. If brought hither, as some suppose, by one of the Crusaders, it cannot have been the object of the pilgrimages from which the town took its rise. It was certainly much venerated in the middle ages; and among those who visited it were several popes and nine kings of France. There are three other churches: that of St. Laurent is the burial-place of the bowels of Bertrand Duguesclin, whose tomb was destroyed by Baron des Adrets, the Huguenot leader, in the religious wars; that of St. Michel is remarkable for its situation on the summit of a conical volcanic rock, in which is cut a flight of more than two hundred and fifty steps. As the church is surmounted by a pointed spire, it presents, with the rock on which it stands, the appearance of an enormous cone or obelisk. The office of the prefecture is a handsome modern building, and there are a town-hall, three hospitals, and buildings for the seminary for the priesthood, for the college or high school, for the commercial court, and for the two justices of the peace; there are also a range of cavalry barracks and a large prison. The lower part of the town is partially surrounded by a kind of boulevard, and there is an agreeable public walk.

The population of Le Puy, in 1826, was 14,988; in 1831, was 14,844 for the town, or 14,930 for the whole commune: in 1836 it was 14,924 for the commune. The chief manufacture is that of blond and other lace, which employs all the poorer women in the town and neighbourhood. The lace is exported, chiefly to North America. Blankets and woollen stuffs, and coarse woollen cloths, are made; woollen yarn is spun, and wool dyed. Lime-burning, brewing, and the tanning and currying of all kinds of leather are carried on; goat-skin bags or bottles for wine, oil, &c. are made; and hats, nails, and the small bells used by the muleteers and carriers in the centre and south of France are manufactured. The trade carried on is chiefly in grain and pulse, in which the neighbourhood is very productive, lace, and leather. There are fifteen yearly fairs. A great quantity of wine is produced in the neighbourhood, but, from its inferior quality, it is consumed only among the poorer classes.

There are, besides the institutions already mentioned, a cabinet of natural history, a museum of paintings, sculptures, and antiquities; a public library of 6000 volumes; a theatre, and a departmental nursery.

Le Puy is in the volcanic district of Central France; the surrounding mountains are granitic, capped with masses of rock of volcanic origin. The cubical rock Corneille, which commands the town, that of Polignac, about a mile distant, and that of St. Michel, crowned by the church of that name, are all of volcanic origin; and at the village of Expailly, close to the town, are a group of basaltic rocks, in the form of perpendicular prisms, and on a neighbouring mountain other basaltic rocks, formed of horizontal prisms. Among these natural curiosities are the remains of some buildings of the Roman period or of the middle ages.

The arrondissement of Le Puy comprehends 112 communes, and has an area of 860 square miles. The population in 1831 was 129,722; in 1836, 130,844. It is divided into fourteen cantons or districts, each under a justice of the peace.

The diocese of Le Puy comprehends the department of Haute Loire. The bishop is a suffragan of the archbishop of Bourges.

PUY DE DÔME, a department of Central France, bounded on the north by that of Allier, on the east by that of Loire, on the south by those of Haute Loire and Cantal, and on the west by those of Corrèze and Creuse. Its form approaches to that of a regular quadrangle, having its greatest length from east to west, from the neighbourhood of St. Anthême to the banks of the Chavanoux, 72 miles; and its greatest breadth from north to south, from the neighbourhood of Montaigu to the border of the department of Cantal, 60 miles. The area of the department is estimated at 3087 square miles, exceeding the average area of the French departments in the proportion nearly of 4 to 3, and surpassing the conjoint areas of the English counties Kent and Sussex. The population in 1831 was 573,106; in 1836, 589,438: showing an increase in five years of 16,332, or nearly three per cent., and giving 191 inhabitants to a square mile. Both in amount and density of population it is inferior to very few departments, and very far exceeds the average in both respects. In density of population it slightly exceeds the county of Sussex, but falls far below Kent. Clermont-Ferrand, the capital, is near the mountain Puy-de-Dôme, on a small feeder of the Allier, 216 miles in a direct line south by east of Paris, or 232 miles by the road through Nevers and Moulins; in 45° 46′ N. lat. and 3° 5′ E. long.

The department is very mountainous. The principal chain of the Auvergnat mountains crosses the department from north to south. The Monts-Dômes, in the centre of the department, form part of the chain; the loftier group of the Monts-Dor, which are to the south of the Monts-Dômes, also belong to it. On the eastern border of the department is the chain of the mountains of Forez, and La Madeleine, or La Made, separated from that just described by the broad valley of the Allier; and on the north-western border, separated from the principal chain by the valley of the Sioule, is a subordinate ramification of the Auvergnat mountains. We subjoin the altitudes of the principal summits of the main chain:—Monts-Dômes—Puy-de-Dôme, 4839 feet; Petit Puy or Dôme, 4183 feet; Puy Chopine, 3908 feet; Grand Sarcoui, 3436 feet; Grand Suchet, 4095 feet; Puy de Pariou, 4009 feet; Puy de Côme, 1273 feet; Monts-Dor—Pic de Sancy, summit of Mont-Dor, 6224 feet; Puy Gros, 5925 feet; Puy de Montchar, 3931 feet; Cacadogne, 5929 feet; Puy Ferrand, 6116 feet; Puy de l'Angle, 5748 feet; Puy de la Haute Chaux, 5627 feet; Roche Vendeix, 3872 feet; Roche Sanadoire, 4259 feet. (*Comp. to Alm.* for 1833; Malte-Brun.)

The geology of the department is described elsewhere: it forms part of the district of Auvergne. [AUVERGNE, *Geology of*, vol. iii., p. 157; FRANCE, *General Geological Character*, vol. x., p. 408, seq.]

The department yields coal, lead, ironstone, and antimony. In 1825 a rich bed of alum was discovered at the foot of the Puy de Sancy in Mont-Dor. The number of coal-works in 1834 was eight, giving employment to 164 labourers, of whom 100 worked in the mines. The quantity of coal produced in 1834 was 9830 tons; in 1835, 11,387 tons. There are no iron-works. Gypsum is quarried.

There are several mineral springs, hot and cold. Those of Mont-Dor are the most frequented. Their temperature is 45° Réaumur, or 133° Farenheit: they are sudorific. There are other warm springs at Châtel Guyon (30° Réaumur, 100° Fahrenheit), St. Mark (25° Réaumur, 88° Fahrenheit), St. Nectaire (38° Réaumur, 118° Fahrenheit), Bourboule (52° Réaumur, 149° Fahrenheit), Châteauneuf (38° Réaumur, 118° Fahrenheit). There are cold mineral waters at Bar, Châteldon, Vic-le-Comte, and St. Myon, the last chalybeate.

The department belongs to the basin of the Loire, except a small portion at the south-western corner, which is included in the basin of the Garonne. The Loire itself is beyond the boundary of the department; but the Allier, one of its principal tributaries, enters the department on the south side, between Auzon and Nonnette, and flows northward for about 58 miles, till it enters the department of Allier above Vichy. It receives numerous tributaries; the Alagnon, the Couze, the Crouse, the Couses, the Monne, the Lachau (which receives the Ambène and the Morges), all small streams from the main chain of the Auvergnat group, on the left bank; and the Dore, which receives the Acredogne and some smaller streams from the mountains of Forez, and La Madeleine, on the right bank. The Sioule, which joins the Allier in the department of Allier, waters the valley between the principal Auvergnat chain and the subordinate ramification. It receives the Couleiron, the Sioulet, and some other small streams. The Cher, one of the principal feeders of the Loire, just touches the north-western border. That portion of the department which is in the basin of the Garonne is watered by the Dordogne, which rises on the slope of Mont-Dor, and its tributaries the Chavenoux and others. There are several small lakes in the principal chain or the subordinate ramifications of the Auvergnat mountains; from the latter lakes some of the feeders of the Sioule flow. Lake Pavin, near Mont-Dor possesses some remarkable features. It is in a circular basin or hollow, resembling the crater of a volcano. Its margin is covered with wood, which owes its verdure to the refreshing dews produced by the copious evaporation of the lake, which is of great depth. The waters are very dark. The little river Crouse flows from this lake. The rivers and lakes abound with fish.

None of the rivers are navigable, except the Allier; and in Brué's *Map of France* (Paris, 1818) the navigation of the river is marked as commencing just where it quits the department. But the official document, *Statistique de la France*, assigns to it a navigation of 58 miles within the department, comprehending all that part of its course which is within the boundary. The difference arises from this part of the river being navigable at particular seasons, and only with the stream. There are no canals; and the industry of the department suffers materially from the want of water-conveyance.

There are seven government roads, having an aggregate length of 278 miles, viz. 127 in good repair, 84 out of repair, and 67 unfinished (1 Jan., 1837). The principal road is that from Paris by Clermont to Montpellier. It enters the department on the north, a short distance beyond Gannat in the department of Allier, and runs through Aigue-Perse, Riom, Clermont, Issoire, and St. Germaine-Lambron, beyond which it enters the department of Haute Loire. A road runs eastward from Clermont by Thiers to Lyon (Rhône); another westward by Aubusson (Creuse) to Limoges (Haute Vienne); and a third south west by Tulle (Corrèze) and Périgueux (Dordogne) to Bordeaux (Gironde), with a branch by Aurillac (Cantal) to Toulouse (Haute Garonne). The departmental roads have an aggregate length of 223 miles, of which (1 Jan., 1837) 111 were in repair, 44 out of repair, and 68 unfinished. The bye-roads and paths have an aggregate length of 7000 to 8000 miles.

The soil varies. The sides of some of the volcanic 'puys,' or mountains, are covered with fine grass, in which numerous cattle are pastured, and others are covered with extensive woods; the lower hills and slopes are occupied by fields of rye, oats, hemp, buckwheat, and potatoes, or by sheep-walks, with a little wood. The mountains of Forez and La Madeleine are covered with woods or with barren heaths. The valley of the Allier, known as the 'Limagne of Auvergne,' is eminent both for fertility and beauty: it produces in great abundance wheat, barley, oats, wine, and fruits of various kinds, especially walnuts, and hemp. The higher grounds produce rye. The quantity of land in the department under the plough is estimated at nearly one-half the whole area. The meadows occupy one-ninth of the area: the heaths and open pastures occupy one-fourth. The quantity of cattle reared is very great: they form an im portant article of traffic, and furnish an abundance of cheese and butter, of which the cheese is exported in considerable quantity. The vineyards are not so extensive as in many other departments: the best red wines are those of Chanturgue, Chateldon, and Ris; the best white wines are those of Corent. The woodlands occupy above a tenth of the area. The pine grows on the summits of the mountains, below them the beech grows, and still lower down are the oak, the service-tree, and the chestnut: the last furnishes an important article of food to the poor mountaineers. A considerable quantity of charcoal is made, and timber for masts and building is exported; walnut-oil is also an important article of trade.

The peasantry of the department are a primitive race, little instructed, and wedded to long established usages. In their heavy wooden-soled shoes, or sabots, they drive their cows or oxen attached to creaking cars, the wheels of which are without tire, or guide their clumsy plough: the words with which they stop their eam, 'sta, bos,' indicate by their Latin form the long continuity of their usage. Their cottages are wretched, and their fare miserable. They are however industrious and honest: but long-standing prejudices have obstructed their improvement.

The department is divided into five arrondissements, as follows:—

Arrondissement.		Area in sq. miles.	Communes.	Population in 1831.	Population in 1836.
Clermont	Central & West	692	107	171,566	175,910
Ambert	S E.	473	52	87,616	90,675
Issoire	S. & S.W.	705	116	99,559	100,740
Riom	N. & N.W.	885	130	146,495	151,456
Thiers	N.E.	332	39	67,870	70,657
		3087	444	573,106	589,438

It comprehends forty-seven cantons or districts, each under a justice of the peace.

The arrondissement of Clermont contains Clermont-Ferrand, capital of the department (population in 1831, 24,077 town, 28,257 whole commune; in 1836, 32,427 commune) [Clermont-Ferrand], on a feeder of the Allier; St. Amand, Montons, Le Crest, Les Martres, Cournon (population 2664), Lempde (population 1883), Beaumont (population 1858), Aubières (population 3513), Cebassat (population 2583), Gerzat (population 2498), and Pont du Château (population 3429), between the main chain of the Auvergnat mountains and the Allier: Beauregard, Vertaizon (population 2735), Mirelleur, Vic-le-Comte (population 2150 town, 3153 whole commune), and Billom (population 4157 town, 4746 whole commune), near the east bank of the Allier. All these places are in the Limagne. Rochefort, near the Sioule, Herment, near the Sioulet, and Bourg Lastic, near the Chavanoux, are on the western side of the principal mountain-chain. Les Martres, or more fully Les Martres de Vayre (population in 1831, 1920 town, 3026 whole commune), is near the bank of the Allier; the townsmen carry on trade in wine. Montons has probably about the same population in its commune. Pont du Château occupies the summit and slope of a hill on the left bank of the Allier, over which river is a fine bridge of eight arches. On the highest ground in the town is a mansion formerly belonging to the family of Montboissier, now to the municipal authorities; and attached to this mansion is a park. Pont du Château is a place of rendezvous for the boats which descend the stream, laden with coal, wine, &c. A considerable fishery is carried on on the river. Limestone quarries are worked in the neighbourhood, from which chalcedony and crystals of quartz are procured. Beauregard has a castle or mansion, formerly belonging to the bishops of Clermont, commanding a fine prospect. Vic-le-Comte (otherwise Vic-sur-Allier) takes its designation from having been for a long time the residence of the counts of Auvergne. It has mineral waters of considerable repute, and the ruins of a very beautiful antient chapel. Billom was in the middle ages the seat of a school of good repute, and was a place of some note during the war of the League. The townsmen spin linen-yarn, and carry on trade in the hemp and oil produced in the surrounding country. There is a commercial tribunal at Billom. The antient school exists at present as a secondary ecclesiastical school, and is under the direction of some Jesuits. Herment has sixteen yearly fairs for horses, horned cattle and sheep, grain, hemp, yarn, charcoal, and coal.

In the arrondissement of Ambert are Ambert (population in 1831, 3470 town, 7650 whole commune; in 1836, 8016 commune) [Ambert], Olliergues, Marsac (population 3206), Arlant or Arlanc (population 3567), on or near the Dore; St. Anthême (population 3286), and Viverols, in the country on the right bank of that river; and Cunlhat or Cunlhac (population 3470), St. German-Lherm, and St. Bonnet, in the country on the left bank. Olliergues or Oliergues has some manufactures of coarse linens and other woven stuffs: Marsac has manufactures of tapes, laces, linens, &c.; also some tanyards. Arlant and Viverols have manufactures similar to those of Marsac. Camlets, linens, and other woven goods are also made at Cunlhat. St. Germain-Lherm has several fairs for cattle, wool, woollen yarn, and hemp. At the village of St. Amand-Roche-Savine, between Ambert and Cunlhat, lead-mines are worked.

In the arrondissement of Issoire are Issoire (population in 1831, 5990 for the commune; in 1836, 5741), Nonette, St Germain-Lambron (population 1938), and La Mongie, on or near the Allier; Sauxillanges and Usson, in the country or the east or right bank of that river; Ardes, on the Couze; Besse and Vodable, on or near the Crouse; Champeix, on the Couses, and La Tour, on a feeder of the Dordogne west of Mont-Dor. Issoire is a walled town on the Couze, a short distance from its junction with the Allier. It was formerly a place of strength, and in the war of the League sustained two sieges, by which it was nearly destroyed. The town is small and ill built. It has a very antient church, adorned outside with ornaments in mosaic. There is a covered market built of granite. The population is partly agricultural, the principal articles of growth in the neighbourhood are wine and hemp (which are sent, the former to Paris, the second to Nantes), and walnuts, in the oil of which considerable trade is carried on. The neighbouring district yields antimony and coal. Copper cauldrons and other utensils are made in the town. There are some judicial and fiscal government offices. Issoire was a place of some importance in the middle ages. Nonette is on a hill, nearly surrounded by the Allier, and was in the middle ages a place of strength. The counts of Auvergne had a castle here, which was rased in 1658 by order of the king, Louis XIV. At St. Germain-Lambron considerable trade in corn and wine is carried on; and there are several yearly fairs for cattle, timber, and corn. There are coal-pits near La Mongie. At Sauxillanges woollen stuffs, scythes, sickles, saws, and earthenware are made. Usson has the ruins of a castle, built of basalt, one of the strongest fortresses of the middle ages. It was for twenty years the residence of Marguerite (Margaret) of France, queen of Henri IV.; and was razed in the reign of Louis XIII. Besse is in the midst of picturesque scenery. It is built of basalt. The townsmen carry on trade in cattle and cheese. Flax is extensively cultivated in the surrounding district. Vodable or Vaudable has some ruins of a former residence of the counts of Auvergne. La Tour, distinguished as La Tour d'Auvergne, situated on a basaltic height, was the hereditary lordship of the last family which possessed the county of Auvergne. The ruins of the castle of these nobles still remain. There are several considerable yearly cattle-fairs. In the commune of Auzat, on the Allier, near Issoire, are iron and coal mines, and a glass-house for making bottles.

Just within the limits of this arrondissement is the village of Mont Dor-les-Bains. It is on the north-western slope of Mont Dor, near the source of the Dordogne, over which there is an iron bridge. The baths, a modern erection of volcanic rock, and of simple but solid and elegant architecture, are on the site of those erected by the Romans, by whom the mineral waters of the place were esteemed. The village, which has of late years been much enlarged and improved, is frequented during the season (which lasts from the commencement of June to the middle of September) by a great number of bathers. There are some remains of Roman buildings, and the picturesque scenery which surrounds Mont Dor increases the attractions of the place.

In the arrondissement of Riom are Riom (pop. in 1831, 11,992 town, 12,379 whole commune; in 1836, 11,473 commune [Riom], and Ennezat, on the Ambène or Eubenne, a feeder of the Lachau; Volvic (pop. 1914 town, 3032 whole commune), on another feeder of the Lachau; Manzat, Combrondes, and Artonne, on the Morges, a third tributary of the same stream; Randans and Aigueperse (pop. 3217) near the northern boundary of the department; Pont Gibaud, St. Gervais, and Menat, on or near the Sioule; and

Giat, Pionsat, and Montaigu les Combrailles, near the north-western boundary of the department. Volvic is on a volcanic site, and is built of lava quarried in the neighbourhood. There is in the town a school of design and of sculpture for architectural ornaments, the works of which, comprehending shafts of columns and capitals, funereal monuments and slabs, are chiefly of lava. The quarries are very curious; they furnish a section of successive currents of fused volcanic matter, increasing in closeness of grain in proportion as they are deeper beneath the surface. The lava is generally porous, but susceptible of a certain polish so as to be available for sculpture. Clermont-Ferrand, Riom, and most of the neighbouring towns are built of it; and for many years past large quantities have been sent to Paris for foot-pavements. Aigue-Perse is pleasantly situated, and consists of one wide and very long street on the road from Paris to Clermont, lined with houses, generally well built. The principal church has a tolerably good painting of St. Sebastian. Near the town is the château of La Roche, the birthplace of the celebrated chancellor Michael L'Hopital, and a spring, from which noxious exhalations of carbonic acid gas arise. At Pont Gibaud are a saw-mill and an extensive flour-mill. There are mineral springs and lead-mines in the neighbourhood. Black and red tripoli are obtained near Menat. Giat has a monthly fair for cattle, butter, and cheese.

In the arrondissement of Thiers are Thiers (pop. in 1831, 6586 town, 9836 whole commune; in 1836, 9982 commune), on a feeder of the Dore [THIERS]; Croupière or Courpierre, Puy-Guillaume, Châteldon, and Ris, on or near the Dore; Maringues (pop. 3072 town, 4181 whole commune) on the Lachau; Lezoux (pop. 1630 town, 3447 whole commune), between the Allier and the Dore; and Vollorre or Vollore (pop. 3881), in the country east of the Dore. At Courpierre is a bone-mill for grinding bones for manure. At Puy-Guillaume the pines of the neighbouring mountains are cut by saw-mills into deals and planks. Châteldon has mineral waters; and both this town and Ris are situated in a wine-growing district, and carry on trade in wine. At Maringues, chamois and other leather is manufactured, and a large corn-trade is carried on, favoured by the situation of the town, which is in the most fertile district of the Limagne. Lezoux, on the road between Thiers and Clermont, is a neat town, with a fine market-place, two small public walks, and an hospital. There are four yearly fairs, at which considerable business in corn and hemp is done. In the neighbourhood of Vollore is a Roman milliary column with an inscription in honour of the emperor Claudius Cæsar. At St. Remy, near Thiers, which, though only a village, has a population of about 4000, a considerable quantity of cutlery is manufactured.

The industry of the department is considerable: the paper of Ambert, the cutlery of Thiers, and the lava ornaments of of Volvic are among its principal productions; but its development is checked by the want of sufficient means of water-carriage. The project has been conceived of forming a lateral canal on the bank of the Allier, but no steps have been taken to carry the plan into effect.

The department constitutes the diocese of Clermont, the bishop of which is a suffragan of the archbishop of Bourges. It is in the jurisdiction of the Cour Royale of Riom, and in the circuit of the Académie Universitaire of Clermont, and in the nineteenth military division, the head-quarters of which are at Lyon. It returns seven members to the Chamber of Deputies. In respect of education it is one of the most backward of the departments of France. Of the young men enrolled in the military census of 1828-29, only 19 in every 100 could read and write, while the average of France was more than twice that number.

At the period of Cæsar's invasion the country now included in this department formed part of the territory of the Arverni or Arvernians, one of the most powerful of the Celtic nations, and leaders, with the Sequani, of one of the two great factions into which the Gauls were divided. Strabo writes the name of this nation 'Αρουερνοί, Plutarch 'Αρβερνοί. They had several other nations dependent upon or subject to them, as the Eleuteti, the Cadurci, the Gabali, and the Velauni. They had sustained some severe conflicts with the Romans before Cæsar's time; and in the general revolt against Cæsar, in the seventh year of his command, they acted a conspicuous part. Vercingetorix, the leader of that revolt, was an Arvernian [BOURGES; BOURGOGNE]; and Gergovia, the siege of which Cæsar was obliged to raise, was an Arvernian town in the neighbourhood of Clermont. The site of Gergovia is a mountainous ridge composed of volcanic and calcareous rocks, rising to between 2400 and 2500 feet above the level of the sea; it has a tolerably level summit nearly four miles in circuit, and agrees in other respects with the description of the locality given by Cæsar (*De Bell. Gall.*, lib. vii., 36-46).

In the subdivision of the diocese of Gaul under the emperors, the Arverni were included in the province of Aquitania Prima. The chief town of the nation, called at first Augustonemetum, afterwards Arverni, may be identified with Clermont-Ferrand, the capital formerly of the province of Auvergne, and now of the department. A station in the Peutinger Table, called by the frequently occurring name of Fines, was probably near the boundary of the department, in the subordinate ramification of the Auvergnat mountains. Martialis, mentioned by Sidonius Apollinaris, was near Volvic; and a station, the name of which appears in the Peutinger Table in the mutilated form Ub...m (perhaps Ublium or Ulbium), may be conjectured to be Olbie or Olby, on one of the early tributaries of the Sioule.

On the overthrow of the Romans, the country came into the hands of the Visigoths, and subsequently of the Franks. In the middle ages it was included partly in the county of Auvergne, but chiefly in the Dauphiné of Auvergne. A considerable district belonging to the province of Bourbonnais, and a small portion of Forez, a subdivision of the province of Lyonnais, are also included.

PUY LAURENS. [TARN.]

PWLLHELI. [CAERNARVONSHIRE.]

PYDNA. [MACEDONIA.]

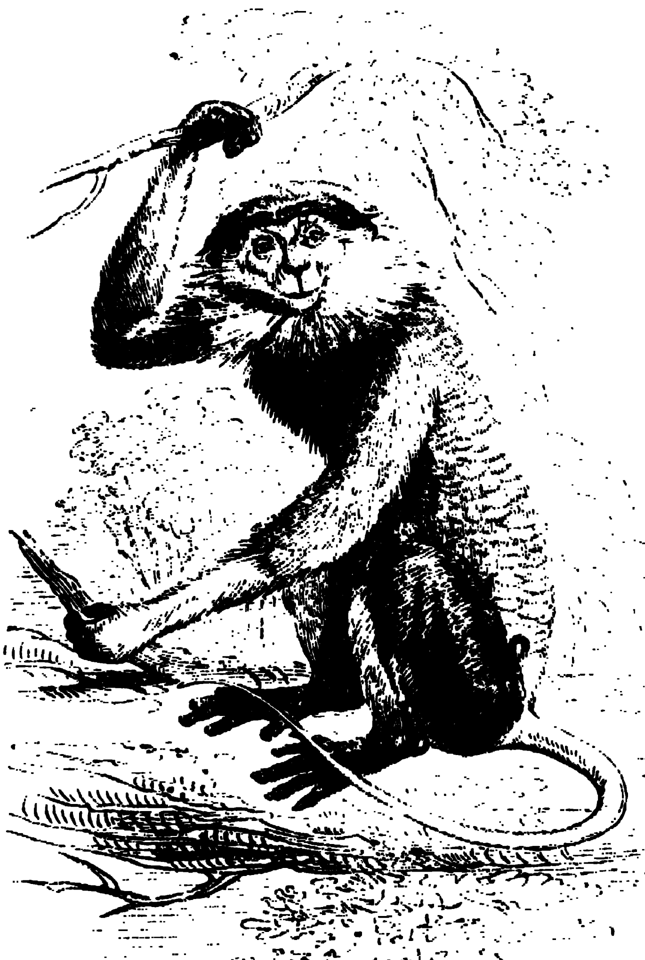
PY'GATHRIX, M. Geoffroy's name for the Doue, or Cochin-China Monkey (*Lasyopyga*, Ill.).

Generic Character.—Head rounded; muzzle moderately prolonged; tail long; cheek pouches; hands longer than the fore-arms and the legs; anterior thumbs very short and slender; no callosities; buttocks fringed with long hairs.

Dental Formula:—

$$\text{Incisors } \frac{4}{4}: \text{ canines } \frac{1-1}{1-1}: \text{ molars } \frac{5-5}{5-5} = 32.$$

Example, *Pygathrix Nemæus*, Geoff. (*Lasiopyga Nemæus*, Ill.; *Simia Nemæus*, Linn., *Mant.*)



Pygathrix Nemæus.

This very rare monkey is perhaps the most remarkable of the whole tribe for the variety and liveliness of the colours with which it is marked, and which are the more striking from being distributed in large masses.

Description.—Upper part of the head brown with a dark reddish chesnut frontal band. The cheeks are clothed with very long and whitish or yellowish white hairs. The back, the belly, the arms, and the sides are grey with a somewhat greenish cast; the tail is whitish, and so are the rump and the forearms; the anterior fingers are blackish; the hips and thighs are blackish, and the legs of a brightish red chesnut; the more exposed parts of the face are of a reddish tint. Length rather more than two feet when erect; length of tail about 1 foot 7 inches.

Locality.—Cochin-China. Little or nothing is known of its habits.

PYGODA'CTYLUS. [Bipes; Ophiodes; Scelotes; Scincoideans.]

PY'GOPODES, Illiger's name for those natatorial birds whose wings are well developed, and whose feet are placed very far back so as to facilitate their diving, as Colymbus, Uria, Alca, &c. [Divers: Auk.]

PY'GOPUS. [Bipes: Ophiodes; Scincoideans.]

PYLORI'DIANS, *Pyloridea*, M. de Blainville's name for his ninth family of *Lamellibranchiata*, which he thus characterises:—

Body compressed, more and more cylindrical, the mantle more and more closed and prolonged backwards by two long tubes which are ordinarily distinct, with an anterior and inferior aperture for the passage of a very small and ordinarily conical foot; branchiæ narrow, free, and prolonged in the tube.

Shell regular, rarely irregular, nearly always equivalve, gaping at the two extremities; hinge incomplete, the teeth gradually vanishing (s'effaçant peu en peu); ligament internal or external; two distinct muscular impressions, united by a pallial impression which is very flexuous backwards.

M. de Blainville remarks that all the animals of this family live enclosed in the mud, the sand, or calcareous stone, almost without ever changing their place, always in a vertical position, the mouth below and the anus above. All their shells, he observes, (ordinarily white, and covered with an epidermis), hardly ever exhibit any striæ from the umbo to the base, but only lines of growth (stries d'accroissement).

Section 1. (Ligament internal.)

Pandora.

Generic Character.—*Animal* oval, compressed, rather elongated, with the mantle in form of a case, terminating backwards by two tubes united at their base only, and rather short, opening anteriorly for the passage of the foot, which is large, triangular, thick and swollen at its extremity; branchiæ large, free backwards, where the two pairs are united and terminate in a point in the siphon; labial appendages rather large, triangular, and not striated.

Shell delicate, regular, elongated, compressed, inequivalve, inequilateral, having the right valve flattened and the left more or less convex; umbones but little distinct; hinge composed of a cardinal tooth in the right valve, corresponding with a cavity in the left; ligament internal, oblique, triangular, inserted in a little pit with rather projecting edges; muscular impressions rounded, that of the mantle but little apparent and forming a small excavation. (Rang.)

M. Deshayes, for cogent reasons detailed in the last edition of Lamarck, is of opinion that both *Corbula* and *Pandora* should be arranged with the *Myæ* in the same family, viz. the *Myarians*, or *Myidæ*, and thus the family *Corbulidæ* would be obliterated as useless. He observes that when Lamarck wrote, but two living species were known. When M. de Blainville and M. Rang wrote, no more living species had been discovered, but they notice two fossil species. M. Deshayes further remarks, that Mr. G. B. Sowerby has published seven species in his *Species Conchyliorum*, and he refers to the descriptions of Mr. Say and of M. Quoy in the *Voyage of the Astrolabe*. This, with two fossil species, one from the environs of Paris and the other from Italy, makes, he observes, twelve species in a genus to which two species only were known to belong for some years. Notwithstanding this declaration, only eleven species, including but one fossil, appear in the text. In his Tables the number of living species given is seven and of fossil (tertiary) three. A *new species* and *Pandora rostrata* are recorded as both living and fossil (tertiary).

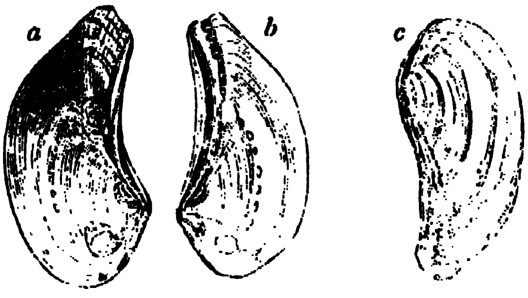
Habits of the Genus.—The *Pandoræ* live sunk in the sand so deep that it requires some difficulty to get them out. They have been found at depths varying from the surface to ten fathoms.

Geographical Distribution.—Wide. Species are recorded from Norway, the European seas, including the Mediterranean, the Pacific, the coasts of Georgia and Florida in North America, and New Zealand.

Example, *Pandora rostrata*.

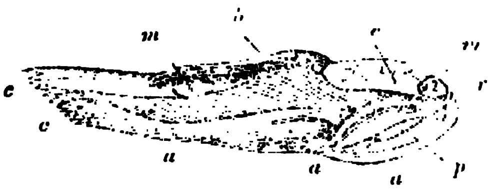
Description.—Shell with the anterior side produced, attenuated, rostrated, and angulated in each valve.

Localities.—Coasts of England and France, and the Mediterranean.



Shell of Pandora Rostrata.

a, Interior of deep valve; *b*, interior of flat valve; *c*, valves closed.



Soft parts of Pandora Rostrata.

a, *a*, *a*, *r*, Mantle, opened anteriorly to show the issue of the foot; *p*, foot; *b*, rectum; *e*, liver covered by the ovary; *m*, adductor muscles; *c*, *c* tubes

Mr. Cuming informs us that he has brought home several new species of *Pandora* from the Philippine Islands.

Mr. Garner, in his interesting paper 'On the Anatomy of the Lamellibranchiate Conchifera,' gives a view of the soft parts of a Pandora in the shell. (*Zool. Trans.*, vol. ii., pl. 18, *fig.* 6.)

Anatina.

Generic Character.—*Animal* oblong, rather thick, having the mantle closed by a rather large membranous lamina with a small rounded aperture at the antero-inferior part for the passage of a linguiform foot; two elongated tubes separated deeply at their extremity, the lower being rather greater than the upper; branchiæ narrow, free, and pointed backwards.

Shell delicate, sometimes translucent, oval, elongated or oblong, gaping at one or both extremities, equivalve; very inequilateral; umbones placed backwards, the upper anterior border being longer than the posterior; hinge without teeth, but having in their place a horizontal excavated apophysis or spoon-shaped process, receiving the internal ligament, and sustained by a lamina which is oblique and decurrent into the interior of the shell; muscular impressions distant, oval, united by a pallial impression which is but litte marked, but having a deep and rounded excavation backwards. (Rang.)

The genus *Anatina* does not appear in the Tables of M. Deshayes, but *Thracia* does. In the last edition of Lamarck, that acute malacologist observes, that having discovered in the hinge of many of the *Anatinæ* of Lamarck, as well as in that of other species which Lamarck did not know, a frail process (*osselet caduc*) which is free and retained solely by a part of the ligament, he has circumscribed certain genera founded upon the form and position of this process. Thus, he observes, there exists in the three first species of Lamarck's *Anatinæ* (*Lanterna*, *truncata*, and *subrostrata*) a tricuspid process or *osselet* applied upon the anterior side of the spoon-shaped processes; two branches of the process or osselet reach to the umbo, and there occasion a natural and constant fissure, closed by a very delicate membrane; the spoon-shaped process is narrow, and sustained by a buttress-like lamina. These shells are excessively delicate, and gape very much posteriorly.

He further remarks that in the *Anatina trapezoïdes*, of which Bruguière made a *Corbula*, and on which Schumacher founded his genus *Periploma*, the cardinal process or *osselet* is in the shape of a wedge (coin) placed between the dorsal border and the spoon-shaped process; the umbo is not slit, and the shell, which is very inequivalve, does not gape.

A quadrangular osseous plate applied along the border, and sustained between spoon-shaped processes, which are very narrow and do not project, characterises another genus, to which M. Deshayes has given the name of *Osteodesma*. Example, *Osteodesma corbuloïdes* (*Mya Norvegica*, Chemn.; *Amphidesma corbuloïdes*, Lam.). The *Anatina longirostris* of Lamarck belongs to this genus.

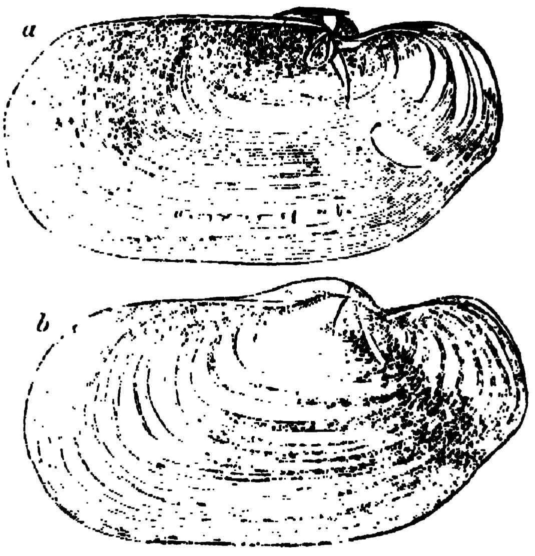
Finally, M. Deshayes remarks that the *Anatina myalis* of Lamarck appears to have no *osselet* at the hinge, but its ligament and spoon-shaped processes have a particular form. On this species Dr. Leach founded his genus *Thracia*, which M. Deshayes adopts, and to which he has added many species.

Thus, M. Deshayes reduces the true *Anatinæ* to three species only, and from the other species adds the genera *Periploma*, Schum., *Osteodesma*, Desh., and *Thracia*, Leach. These may be comprised under the family name of *Anatinidæ*.

We select as an example one of the true *Anatinæ*, viz. *Anatina subrostrata*.

Description.—Shell ovate, membranaceous, anterior side attenuated and subrostrated.

Locality.—Seas of New Holland. Lamarck adds, the Indian Ocean.



Anatina Subrostrata.
a, Inside view of valve, showing the hinge, &c.; *b*, external view; valves closed.

Habits.—The *Anatinæ* have hitherto been found for the most part in sands and shallow water.

Mr. Cuming informs us that he has brought home several new species of *Anatinidæ* from the Philippine Islands.

Anatinæ prismatica and *costata*, described by Mr. G. B. Sowerby, from Mr. Cuming's 'Western Voyage' (*Zool. Proc.*, 1834, *Müller*, *Syn.*), are not noticed in the last edition of Lamarck (1835), nor are *Periplomata lenticularis* and *planiuscula* described by Mr. G. B. Sowerby from the same collection (*loc. cit.*). M. Deshayes (ed. Lam.) observes that he knows but of one species of *Periploma*, viz. *Periploma trapezoïdes*.

Mya.

Generic Character.—*Animal* oblong, a little compressed, enveloped in a rather delicate mantle adhering by its borders, closed by a membranous lamina and forming backwards round the tubes a loose envelope in which they are withdrawn; tubes united, of moderate length, a little separated at their summit and radiated at their orifices; foot very small, conical, coming out of the mantle by a small slit situated at its antero-inferior border, in the median line; branchiæ moderate, not much elongated, unequal on the same side; mouth small, having triangular appendages striated like the branchiæ.

Shell enveloped with an epidermis prolonged upon the tubes and mantle of the animal, rather solid, gaping at both extremities, equivalve; umbones projecting but little; hinge composed of one or two oblique folds, diverging backwards from a horizontal, compressed, spoon-shaped process, belonging to the left valve and corresponding to an equally horizontal fosset in the right valve; ligament internal, inserting itself between the fosset and the spoon-shaped process; muscular impressions distant, the anterior elongated, the posterior rounded; pallial impression narrow and deeply excavated. (Rang.)

M. Deshayes, in the last edition of Lamarck, states that there are some species which so connect the *Myæ* with the *Sphæniæ* of Turton, that their genus is only to be determined arbitrarily, and he cites for example *Myæ plana*, *subangulata*, and *gregaria* of Sowerby (*Min. Con.*), in support of this observation. He remarks that between the *Sphæniæ* and the *Corbulæ* properly so called, there exists an insensible transition which permits the separation of the two groups still less than the *Myæ*, and adds that an attentive examination of more than forty species of *Corbulæ*, both living and fossil, discovered to him the relationship which they bear to the *Myæ*. M. Deshayes concludes by observing, that if one could suppose the spoon-shaped processes of the *Myæ* to become flexible, and for it to be possible to bring them to the horizontal position from the perpendicular, we should evidently have the hinge of a *Lutraria;* but by stopping the bend of those processes at about an angle of forty-five degrees, we should have the hinge of *Anatina globulosa*, the *Tugon* of Adanson (*Mya Tugon*, Desh., *Encycl. Méth.*), which is in fact intermediate betweeen the *Myæ* and the *Lutrariæ*.

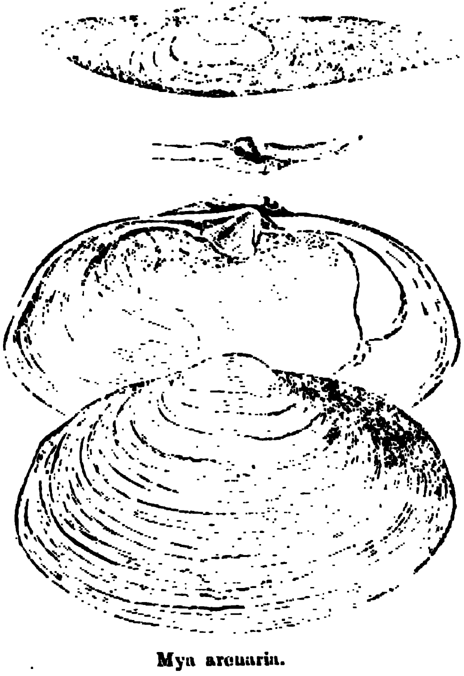
The number of species given in the Tables of M. Deshayes is four living and five fossil (tertiary); *Myæ truncata*, *arenaria*, and *Tugon* are recorded as both living and fossil (tertiary). In the last edition of Lamarck four species only are given, and two of these are noted by M. Deshayes as not being *Myæ*, viz. *Mya erodona*, which he states to be a *Corbula*, and *M. Solemyalis*, which belongs to his genus *Osteodesma*, as already mentioned.

Habits of the Genus.—The Myæ live buried in sandy beaches, wherein they often lie with the tube just projecting: they are also found in the silt of æstuaries.

Example, *Mya arenaria*.

Description.—Shell ovate, rounded anteriorly. The subjoined cut shows the hinge, muscular impressions, markings, and general form of the shell.

Locality.—British Channel, European seas.



Mya arenaria.

Lutricola.

Generic Character.—Body oval, very much compressed or subcylindrical, the mantle only closed in the half of its lower border; foot small, projecting but little beyond the abdominal mass; tubes long, distinct or united.

Shell oval or elongated, regular, equivalve, more or less inequilateral, sometimes scarcely gaping, the edges constantly simple and trenchant, the umbones but little marked; hinge subsimilar, formed of two very small diverging cardinal teeth, sometimes effaced before a large triangular fosset; ligament double, the external posterior rather small, the internal much thicker, and inserted in the fossets; two distinct muscular impressions united by a pallial impression, which is deeply sinuous backwards. (De Blainv.)

M. de Blainville divides the genus *Lutricola* into the two following sections:—

A.

Oval or orbicular species nearly equilateral, very much compressed, gaping but little; hinge similar; internal ligament inserted in the fosset of a vertical spoon-shaped process; two distinct tubes. (Genus *Ligula*, Leach.)

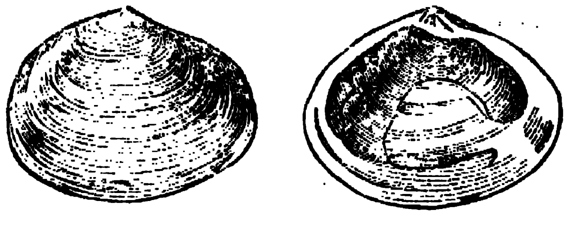
*

Without longitudinal striæ.

Example, *Lutricola compressa.*

Description.—Shell somewhat thin, compressed, rounded-trigonal, squalid, transversely striated, dirty grey, sometimes yellowish or reddish.

Locality.—British Channel.



Lutricola compressa.

B.

Striæ from the umbo to the base.

Example, *Lutraria rugosa* (*Mactra rugosa*, Gm.).

Locality.—European seas.

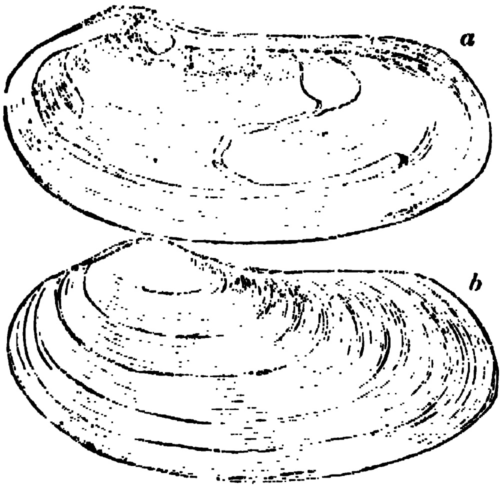
B.

Oblong species, subcylindrical, gaping very much; two very strong hinge-teeth; spoon-shaped process of the ligament vertical. (Genus *Lutraria*, Lam.)

Example, *Lutraria solenoïdes* (*Mya oblonga*, Gm.; *Mactra hians*, Dilw.).

Description.—Shell oblong, with transverse rugiform striæ, anterior end very long, apex rounded, gaping much; dirty white or reddish.

Locality.—European seas.



Lutraria solenoides.
a, Internal view of valve; *b*, external view.

M. de Blainville observes that the species of this genus belong generally to the seas of Europe, three only out of eleven recent species coming from the Indian Ocean. He notices one fossil species from the *faluns* of Touraine.

The genera above collected under the name of *Lutricola* by M. de Blainville belong to the genus *Lutraria* of Lamarck, in the last edition of whose *Animaux sans Vertèbres* M. Deshayes remarks that notwithstanding the observations of Lamarck, the *Lutrariæ* are not so clearly distinguished from the *Mactræ* as one might think. Moreover, he observes, there is so close a resemblance between the animals of the two genera, when deprived of the shell, that it would be impossible to distinguish them; and if the shells themselves be examined, an insensible transition will be found between them and those of the Mactræ. In the two first species of *Lutraria* (*solenoïdes* and *elliptica*) are found a spoon-shaped process and the cardinal tooth in the form of a V, as in the *Mactræ*; the lateral teeth are effaced or rudimentary; but in the third species (*L. rugosa*) the lateral teeth, though very short, show themselves nevertheless as strongly as in many species of *Mactræ*, and if this species preserving the external form of the *Lutrariæ* be followed by *Mactra striatella* and some others, the passage between the genera will be established; for it is impossible to find in the hinges of these species sufficing generic characters. If these three species of Lutrariæ, continues M. Deshayes, pass insensibly into the *Mactræ* [Conchacea, vol. vii., pp. 430, 431], it is different with regard to the greater part of the second section (*L. compressa*, *L. tellinoïdes*, &c.), which bear more resemblance to *Amphidesma* [Conchacea, vol. vii., pp. 429, 430]. Nevertheless those species preserve some traits of resemblance to the *Lutrariæ* which ought not to be neglected. The animals of these species approach more to that of the *Tellinæ* [Conchacea, pp. 428, 429], in the form and length of their siphons, than to those of the *Lutrariæ* and *Mactræ*; so that till the relationships shall be definitively fixed, it will be better to retain the genus *Ligula*, instituted for them by Dr. Leach.

Habits.—Sandy beaches are the localities in which the *Lutrariæ* are principally found buried.

The number of species given in the Tables of M. Deshayes is eleven recent and six fossil (tertiary). *Lutrariæ elliptica*, *rugosa*, and a new species are recorded as both living and fossil (tertiary). In the last edition of Lamarck sixteen species are described: of these *Lutrariæ solenoïdes* and *elliptica* are noted as recent and fossil; and *Lutrariæ crassidens*, *latissima*, and *sanna* as fossil only.

The place of the genus *Anatinella* (G. B. Sow.) is, in the opinion of M. Deshayes, between the *Lutrariæ* and *Thraciæ*, and that of *Cumingia* (G. B. Sow.) [Conchacea, vol. vii., p. 430], between the *Lutrariæ* of the second section and the *Amphidesmata*. The genus *Lyonsia* of the last-named author (*Zool. Proc.*, 1834; Müller, *Syn.*) appears to belong to the *Anatinidæ*. It is placed by Müller immediately before *Anatina*, and under the family *Myacea*, Mke.

Section 2. (Ligament external and convex.)

Psammocola.

Of the genera, or rather subgenera, enumerated by M. de Blainville, and noticed in the article Psammocola, M. Deshayes is of opinion that the genus *Psammobia* should be retained. It comes near to the *Tellinæ*, differing from them more in the shell, which has not the irregular posterior bend, than in the animal, if reference be made only to the figure of Poli. The species figured by MM. Quoy and Gaimard, in the 'Voyage of the Astrolabe,' presents particular characters, observes M. Deshayes, different from those which *Tellinæ* have hitherto shown. *Psammotæa*, he thinks, should not be continued as a genus. (Edit. Lam.)

The species are numerous. In his Tables M. Deshayes gives eighteen as the number of recent *Psammobiæ*, and notices four as fossil (tertiary). *Psammobiæ vespertina* and *muricata* he notes as both living and fossil (tertiary). The number of species of *Psammotæa* recorded is eight recent and one fossil.

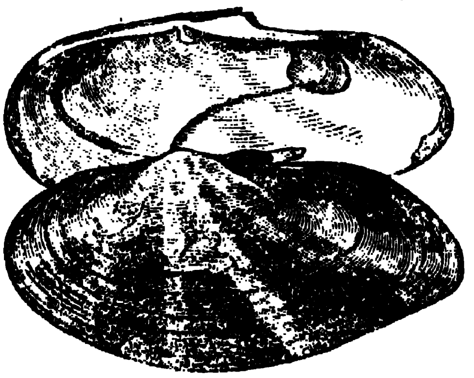
Habits of Psammobia.—Species of this genus have been found in sands at depths varying from near the surface to thirteen fathoms.

Mr. Garner, in his paper on the *Lamellibranchiata* above quoted, gives figures of the animal of *Psammobia florida* in its shell and out of it.

Soletellina.

Generic Character.—Animal unknown.

Shell oval oblong, compressed, with sharp edges, both curved; equivalve, subequilateral, much more wide and rounded at the cephalic extremity than at the other, which is more or less attenuated and subcarinated; the umbones



Soletellina radiata.

submedian, not projecting much; hinge formed of one or two very small cardinal teeth; ligament thick, convex, and supported on very elevated nymphal callosities; two rounded, distant, muscular impressions; pallial impression very sinuous backwards. (Blainv.)

M. de Blainville observes that this genus, which he instituted for four or five species of Lamarck's *Solens*, differs very little from *Psammocola*.

Example, *Soletellina radiata* (*Solen rostratus*, Lam.).

Description.—Shell transversely oblong, violaceous, with many obscure rays; anterior side attenuated and rostrated.

Locality.—Oriental seas.

M. Deshayes observes that *Solen violaceus* and *S. rostratus*, Lam., are referred to the genus *Soletellina* of De Blainville; but he thinks, from the characters of the shells, they ought to belong to *Psammobia*. The animals are unknown.

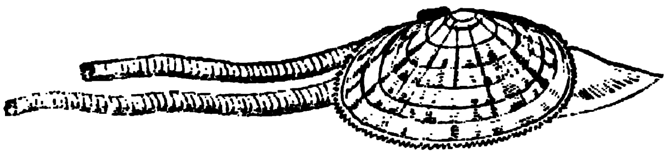
Sanguinolaria.

Generic Character.—Animal very like that of *Psammobia florida*. (Garner, 'Zool. Trans.,' vol. ii., pl. 18, *figs.* 1, 2.)

Shell oval, a little elongated, very much compressed, hardly gaping, equivalve, subequilateral, equally rounded at both extremities, without any posterior carination; umbones slightly indicated; hinge formed of one or two approximated cardinal teeth in each valve; ligament projecting, convex; two rounded muscular impressions, which are distant and united by a narrow pallial impression, which is very sinuous backwards. (Blainv.)

Example, *Sanguinolaria Occidens*.

Both M. de Blainville and M. Rang state that the animal of *Sanguinolaria* is unknown.

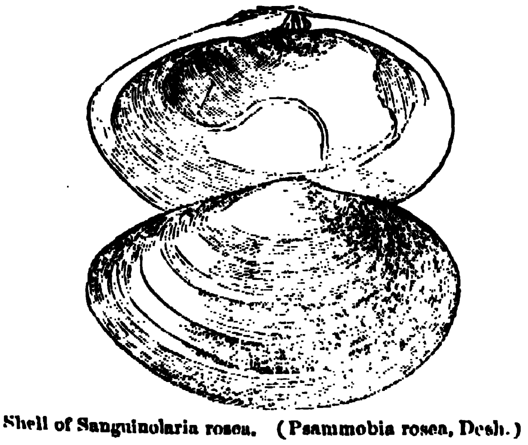


Animal of Sanguinolaria occidens in the shell. (Poli.)

Shell radiated and spotted with whitish and red.

Locality.—Mediterranean.

M. de Blainville speaks of this genus as differing but little from the preceding, and indeed most malacologists have felt the difficulty of discriminating between these closely similar forms. Of the four species recorded by Lamarck, M. Deshayes says that the three first, viz. *Sanguinolariæ occidens, rosea*, and *livida*, are *Psammobiæ*; and that the last, *Sanguinolaria rugosa*, ought alone to remain as a species of the genus. He remarks that Mr. G. B. Sowerby, who has perceived the necessity of reforming the genus, has preserved *Solen sanguinolentus* as its type, joining to it those Solens of which M. de Blainville makes his *Soletellinæ*, whilst he places among the *Psammobiæ* the two species which, in the opinion of M. Deshayes, are true *Sanguinolariæ*. M. Deshayes does not admit Mr. Sowerby's opinion, not only because it is posterior to his own, but also because he believes that all the *Sanguinolariæ* of Sowerby have the characters of *Psammobiæ*, which is not the case with the species (*Sanguinolaria rugosa ?*) which he retains.



Shell of Sanguinolaria rosea. (Psammobia rosea, Desh.)

This species, he observes, is not compressed and tellinoïd; it is thick, regular, pretty well closed, and very long and very thick *nymphæ* give insertion to a very convex and thick external ligament. The cardinal teeth in each valve, continues M. Deshayes, are two; the largest are bifid and cordiform; the muscular impressions are nearly equal and rounded, and the pallial impression forms on the posterior side a narrow and not deep sinuosity.

Description.— Shell semiorbiculate, slightly convex, white, with rosy umbones; the striæ transverse and arcuate.

Locality.—Jamaica. (Lam.)

Habits.—Sanguinolariæ have been found in sands and sandy mud, at depths varying from five to thirteen fathoms.

Mr. Cuming informs us that he has collected several new *Sanguinolariæ* and *Soletellinæ* at the Philippine Islands, &c.

Solecurtus.

Generic Character.—Both M. de Blainville and M. Rang mention the animal of *Solecurtus* as unknown. But see Poli (*Test. utriusque Siciliæ*, vol. i., tab. xii.), and No. 132 E of the *Preparations of Natural History in spirit*, in the museum of the College of Surgeons.

M. de Blainville separates his *Solecurtus* into the following sections:—

A.

Flat, delicate species with an interior bar running obliquely from the umbo to the abdominal edge.

Example, *Solecurtus radiatus*.

B.

More cylindrical species, without an internal bar.

Example, *S. strigilatus*.

C.

Species still more elongated and subcylindrical.

Example, *S. Legumen*.

M. Deshayes confines the genus to those species which have all the same character with *S. strigilatus*.

Generic Character.—Animal much too large for the shell; lobes of the mantle thick forward, soldered together on their posterior moiety, and prolonged on this side into two great unequal siphons united near their summit; foot linguiform, large, very thick; labial palps very long and narrow; branchiæ narrow and very long, extending throughout the length of the branchial siphon.

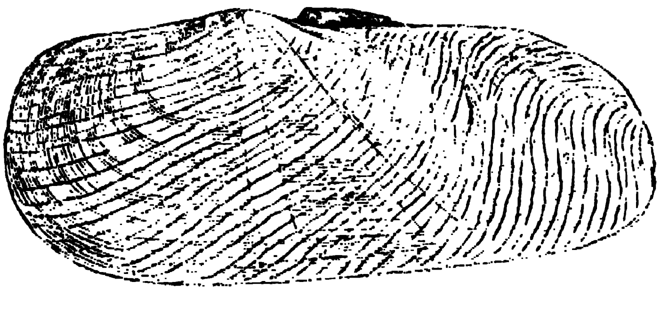
Shell oval-oblong, transverse, covered with undulating oblique and longitudinal striæ, gaping at both extremities. Hinge median, two cardinal teeth in one valve, one, rarely two, on the other, non-intrant; nymphæ callous, thick, supporting an external and convex ligament; pallial impression very deeply sinuous. (Desh.)

M. Deshayes records four species:—1, *Solen strigilatus*, Lam.; 2, *Solen candidus*, Ren., living in the Mediterranean, and fossil in Sicily and Italy; 3. *Solen Quoyi* (*Voyage of the Astrolabe*, pl. 83. f. 11, 12, *Solen candidus*), South Pacific Ocean, smaller and proportionately wider than No. 2; 4, *Solen Parisiensis*, Desh. (*Solen strigilatus*, Lam., and of Deshayes, in *Descr. des Coq. Foss.*). This, which is fossil in the neighbourhood of Paris, Grignon, Courtagnon, Mouchy, Parnes, &c., had been previously confounded by M. Deshayes with *S. strigilatus*, Linn.

Example, *Solen strigilatus*.

Description.—Shell oval oblong, very convex, rosy with two white rays, sculptured with oblique striæ.

Locality, Mediterranean. Lamarck adds Atlantic Ocean.



Solen strigilatus.

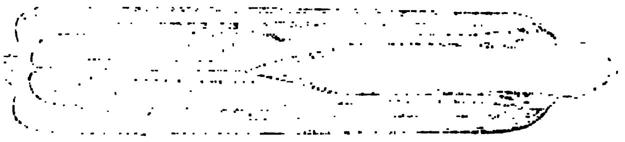
There is a fine specimen with the animal in the museum of the College of Surgeons (*Preparations of Nat. Hist.* in spirit, No. 132 E.).

Solen.

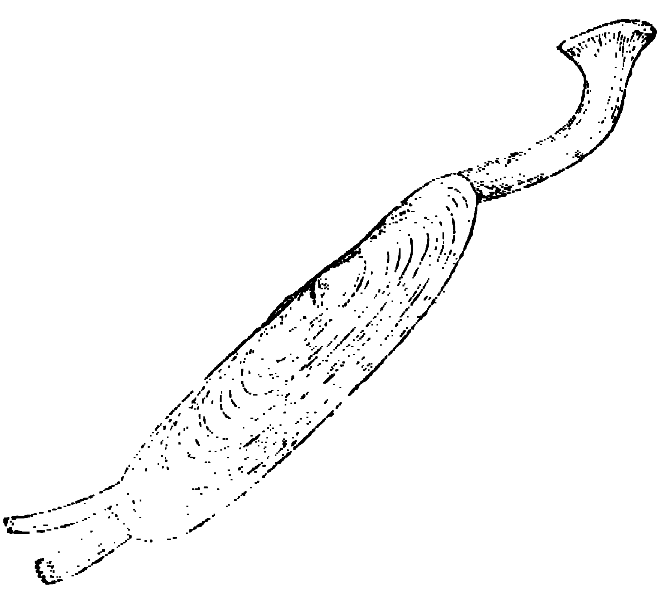
Generic Character.—Animal very much elongated, more or less cylindrical or compressed; mantle closed throughout its length, adhering by its borders, and bound to the lower edge of the shell by a double membrane, which folds back upon itself to form the epidermis, presenting backwards a single tube, double in the interior, conical, annulated, susceptible of much elongation, with two simple orifices, that of the siphon being greater than that of the anus; open entirely in front for the passage of a stout foot, which is conical, convex in its middle, pointed at its extremity, and which terminates the body of the animal in a straight line; branchiæ long, narrow, pointed backwards, nearly of equal size, adhering to two lines forward, one on each side of the body, uniting at last at a certain distance backwards on a single line, and then free and floating up to the entry of the siphon: labial appendages not striated like the branchiæ, elongated, triangular, recurved, and directing their point backwards: mouth small, anus at the extremity of a very small tube floating in the cavity above the free part of the branchiæ.

Shell rather delicate generally, translucid, equivalve, extremely inequilateral, elongated, gaping, truncated at both extremities, and with nearly parallel edges; umbones entirely anterior, hardly distinct; hinge composed of one or two teeth; ligament convex, slightly elongated; muscular impressions very distant, the anterior oblong, elongated, rather narrow, the posterior rather rounded; pallial impression straight, very long, terminated backwards by a short bifurcation. (Rang.)

In the second volume of 'The Descriptive and Illustrated Catalogue of the Museum of the College of Surgeons (Physiological Series),' will be found (p. xix.) two figures of the soft parts of a Razor-shell (*Solen Siliqua*, Linn.), which will throw great light on the organization of this interesting genus. They are represented with the anterior extremity downwards (the natural position of the animal in the sand wherein it burrows when pressed so deftly that it requires sharp digging to overtake it), the anal and branchial tubes projecting from the surface when it is undisturbed, in order to maintain a communication with the sea-water. There may seem an apparent discrepancy between these accurate figures from the MS. catalogue of drawings (No. 28), and M. Rang's description in that part where he describes the mantle as closed throughout its length, and that part of the description of the plate which refers to 'the closed part of the mantle,' and 'the open part of the mantle.' The closed part of the mantle speaks for itself; the 'open part of the mantle' is evidently that which, in M. Rang's description, is 'bound to the lower borders of the shell.' The catalogue informs us that there is a third drawing (No. 29, M.S. Cat.), showing principally the viscera, which are placed at and in the basis of the pendulous body or foot. The mouth, the liver, the stomach, the intestines, and the anus are severally indicated.



Solen Vagina. Shell and soft parts.



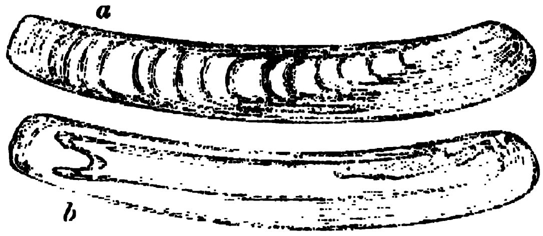
Solen Legumen. Shell and soft parts.

The Catalogue further states that the branchiæ in this class of mollusks are composed of highly vascular membranes, supported by close-set parallel transverse filaments of a delicate horny texture: these are crossed at regular intervals by transverse lines or joints; and along either side of each supporting filament minute vibratile cilia are situated, which move rapidly in different directions, and excite and maintain a perpetual current of sea-water over the surface of the respiratory organs.

Pl. 18, fig. 8, of Mr. Garner's paper 'On the Anatomy of the Lamellibranchiate Conchifera,' shows the stomach, intestine, heart, &c. of *Solen Ensis*. Mr. Garner observes that in *Solen*, *Hiatella*, *Pholas*, &c., the branchiæ are prolonged into the inferior siphon, and so get access to the interior interlaminary spaces of the *branchiæ* (oviducts of some); and by the superior siphon, the *ova*, *fæces*, and secretions are discharged.

Habits of the Genus.—The species live in sandy beaches, wherein they often lie buried in a vertical position two feet deep, though their ordinary habit is to go only so low in the sand or silt (for they are found also in æstuaries) as to leave the tube just projecting. They may be said to have regular burrows. When the animal is undisturbed and the tide is in, it lies with the tubes at the entrance of its perpendicular hole; if it be disturbed, down it goes: in short its life is spent in descending to the depths of its burrow and ascending from it again to the surface by means of the extension and contraction of its great muscular foot, which is situated at that part of the shell which is lowest. They have been found at depths varying from near the surface of the sea to thirteen fathoms.

Localities. — Mediterranean. Lamarck adds Atlantic Ocean.



Shell of Solen Ensis.
a, external view of valves closed; *b*, internal view of valve.

Locality.—Seas of Europe and America. (Lam.)

M. de Blainville thus divides the genus:—

A.

Species somewhat curved longitudinally; umbo not terminal.

Example, *Solen cultellus*.

B.

Species straight, or hardly curved; umbo terminal.

Example, *Solen Vagina*.

M. Deshayes, in his Tables, makes the number of recent species of Solen twenty-six; and nineteen the number of the fossil (tertiary). He records *S. Vagina*, *Legumen*, *coarctatus*, *strigilatus*, *candidus*, and *Siliqua*, as found both in a living and fossil (tertiary) state; and *Solen siliquarius* as being found in more than one tertiary formation. This number includes *Solecurtus*. In the last edition of Lamarck, the number of species, including *Solecurtus*, &c., is twenty-one in all; but with regard to *Solen Vagina*, M. Deshayes remarks, that having seen the types in Lamarck's collection, he is sure that the three varieties constitute three distinct species; and he adds that Lamarck, misled by a resemblance in the external form, has given as the fossil analogue of var. b. *Solen Vagina abbreviata* (Rumph., *Mus.*, t. 45, f. M.).

The genus *Solenella* of Mr. G. B. Sowerby (*Zool. Proc.*, 1832, Müll., *Syn.*), a marine genus allied to *Solecurtus* of M. de Blainville, may here be noticed. In it the general form and characters of *Solecurtus* are combined with a series of minute sharp teeth characteristic of *Nucula*. Mr. Sowerby states that it appears to belong to the family of the *Solenaceæ*, and that it may be at once separated from the *Mactraceæ*, to which, in his opinion, *Nucula* belongs, by the circumstance of the whole of the ligament being external. Established on *Solenella Norrisii*, which was founded by Mr. Cuming at Valparaiso.

Solemya.

Generic Character.—*Animal* oval, transverse; lobes of the mantle united for their posterior half, terminated by two short and unequal siphons; foot proboscidiform, truncated anteriorly by a disk, or kind of sucker, the borders of which are fringed; a single branchia on each side in form of a plumule, the barbs of which are isolated up to the base; anus terminal, not floating. (Deshayes.)

Shell very delicate, fragile, compressed, elongated, rounded at its extremities; the borders straight and parallel, gaping a little backwards, regular, equivalve, very inequilateral, covered with a shining epidermis, which invests it on all sides, except in front and behind; anterior side much longer than the posterior; umbones but little distinct; hinge composed of a cardinal, dilated, compressed tooth, which is very oblique, a little curved above, serving for the insertion of the ligament in each valve; ligament almost entirely posterior; muscular impressions small, rounded, distant; some traces of a pallial impression. (Rang.)

M. Deshayes remarks that *Solemya*, perfectly characterised by the structure of the *branchia*, approaches the *Solens* more than any other genus in the rest of its organization. He adds that he had thought, before the animal of *Glycymeris* was so completely known, and from the resemblance of the shells, that *Glycymeris* and *Solemya* ought to be placed at the commencement of the family of *Solens*. Only three species appear to be known, *Solemyæ Australis*, *Mediterranea*, and *Borealis*. The first from New Holland; the second, as the name implies, from the Mediterranean; and the last from North America (Rhode Island).

Habits of the Genus.—Sands are the localities in which the genus has been found.

Panopæa.

Generic Character.—Animal unknown.

Shell thick, solid, convex, oblique, elongated, gaping at both extremities, equivalve, inequilateral, rather irregular; umbones well marked, contiguous, rather curved forward, and more approximated to the anterior than the posterior part; hinge presenting a conical tooth in each valve in front of a fosset, and of a thick callosity, not projecting outwards, and but little elongated, on which is inserted the external, posterior, and convex ligament; muscular impressions irregularly oval, the anterior the longest, both united by a pallial impression, which is wide, parallel to the border of the shell, and rather deeply excavated backwards. (Rang.)

M. Deshayes observes that when Lamarck published this part of his work, he knew but one species of *Panopæa*: but M. Deshayes, on examining his collection, found that his *Glycymeris Arctica* was of the former genus. At the time M. Deshayes made his Tables, the number of species recorded appears to have been two recent and three fossil (tertiary); and of these, *Panopæa Aldrovandi* is noted as both living and fossil (tertiary). Six (recent and fossil) is the number stated by M. Deshayes in the last edition of Lamarck.

Habits of the Genus.—*Panopæa* has been found in sands and shallow water.

Glycymeris.

Generic Character.—Animal elongated, thick, cylindraceous, having the lobes of the mantle very thick, open only at the anterior extremity for the passage of a small cylindrical foot, and terminated posteriorly by two siphons, united into a single cylindrical very fleshy mass, and never capable of entering the shell; mouth moderate, oval, accompanied on each side by two large equal triangular palps, joined by their base to the anterior adductor muscle. Branchiæ long and thick, two on each side nearly equal. (Deshayes, after Audouin.)

Shell with a strong epidermis, elongated, rounded, gaping at both extremities, rather irregular, equivalve, very inequilateral; umbones projecting but little, skinned (écorchés); hinge toothless, presenting only a thick and but little elongated callosity; external ligament supported by *nymphæ* projecting outwards; muscular impressions distinct and very distant; pallial impression well marked, not excavated posteriorly; valves thickened by callosities in the interior. (Rang.)

The number of species in the Tables of M. Deshayes is one living. In the last edition of Lamarck the same zoologist observes that he has examined the three shells comprised in Lamarck's genus, and that the first only (*Glycymeris Siliqua*) belongs to it. The second (*Glycymeris Arctica*) is, he adds, a true *Panopæa*; and the third (*Glycymeris margaritacea*) is the detached valve of a *Clavagella*, from Grignon.

Habits of the Genus.—Found on sands: moderate depths.

Saxicava. [Lithophagidæ, vol. xiv., p. 50.]

Byssomya. (See the article.)

Rhomboides.

Generic Character.—*Animal.*—Body rhomboidal, elongated, rather compressed, with two distinct tubes backwards; a rather wide slit at the anterior and inferior part of the mantle for the exit of a small conical foot, with a byssus the filaments of which are enlarged at the extremity.

Shell rhomboïdal, rather irregular, striated longitudinally, very inequilateral; umbones very distinct and very anterodorsal; hinge formed by two small cardinal teeth; ligament external, posterior, rather projecting; two rounded muscular impressions.

Example, *Rhomboides rugosus*. Poli, t. 2, p. 21, tab. xv., f. 13.

M. de Blainville established this genus upon a small mollusk figured and described by Poli under the name of *Hypogæa barbata*, and which he refers to the *Mytilus rugosus* of Gmelin. The animal, continues M. de Blainville, is tolerably like *Byssomya*; but the shell is entirely different, and would belong to the genus *Petricola* of Lamarck: but it does not perforate, and lives affixed to rocks by its byssus. M. de Blainville concludes by observing that the genus would perhaps be better placed among the irregular *Veneres*. M. Rang thinks that the genus comes extremely near to *Byssomya*.

Hiatella.

Generic Character.—*Animal* unknown. Shell delicate, elongated, subrhomboïdal, equivalve, very inequilateral, gaping at its inferior border and posterior extremity; umbo very anterior and curved forwards; hinge dorsal, formed of a single tooth in one valve corresponding with a notch on the opposite valve, or of a small tooth with a cardinal fosset on each valve; ligament probably external and dorsal; muscular and pallial impressions unknown. (De Blainville.)

M. de Blainville divides the genus into the following sections:—

A.

Species with a tooth in one valve only.

Example, *Hiatella biaperta*.

B.

Species with a small tooth on each valve. (Genus *Biapholius*, Leach.)

Example, *Hiatella Arctica* (*Mya Arctica*, Oth., Fabr.). M. de Blainville remarks that this genus, established by Daudin, is but badly known, and that it contains but three living species, two from India and the other from the North Seas.

M. Rang, who remarks also on the incomplete knowledge of this genus, thinks that this, perhaps, is not the place for it.

Gastrochœna. (See the article.)

Clavagella. (See the article.)

Aspergillum. (See the article and Tubicolidæ.)

Fossil Pyloridea.

Our limits will not permit more than a reference to the information given under the heads of the respective genera, and the statement that *Gastrochœna*, *Panopæa*, *Mya*, *Lutraria*, *Psammobia*, *Sanguinolaria?* and *Solemya?* occur below the chalk. *Psammobia* and *Mya* are recorded by Mr. Murchison (*Silurian System*), the former as occurring in the lower Ludlow rock, the latter in the Aymestry limestone.

PYLO'RUS. [Digestion; Stomach.]

PYLOS. [Brasidas; Cleon; Messenia; Navarino.]

PYM, JOHN, was descended from a good family in Somersetshire, where he was born in the year 1584. It appears from the abstract of title to certain estates that John Pym was the lord of the manors of Woolavington Pym and Woolavington Throckmorton, near Bridgewater, in the county of Somerset. His son Sir Charles Pym, Bart., afterwards possessed these manors, which at his death descended on coheiresses, and ultimately by marriage passed into the family of Hales (of Kent), who became the representatives of the Pyms.

In the beginning of the year 1599, and the fifteenth year of his age, Pym became a gentleman commoner of Broadgate Hall, now Pembroke College, Oxford. But he left the University without taking a degree, and went, as Wood supposes, to one of the inns of court.

Pym was early distinguished for his eloquence and knowledge in the common law. He served in several parliaments towards the end of the reign of James I., and in all those held in the reign of Charles I., as member for Tavistock in Devonshire. He soon distinguished himself in the house by his abilities and zeal in opposing the measures of the court.

In 1626 he was one of the managers of the articles of impeachment against the duke of Buckingham; and in the Short Parliament, which met on the 13th of April, 1640, he was one of the most active members. When the Long Parliament met (3rd of November, 1640), the value of Pym's knowledge and experience in the usages of the house, as well as of his talents as a speaker, was strongly felt. The reason of this is made apparent by the following words of Clarendon: – 'The long intermission of parliament,' he says, 'having worn out most of those who had been acquainted with the rules and orders observed in those conventions' (*Hist.*, vol. iv., p. 437, Oxford, 1826).

On the 7th of November, the first day in which the house entered upon business, Pym made a long speech respecting grievances. He classed them under three heads, namely: 1, privilege of parliament: 2, religion; 3, liberty of the subject. Each of these divisions, as was usual in that age, he again divided into a great number of subdivisions.

The style of Pym's oratory, as far as we can judge of it from those speeches of his which were printed at the time, and have come down to us among the innumerable small quartos of that age which are preserved in the British Museum, is nervous, terse, and polished.

Upon the 11th of November a motion was suddenly made by Mr. Pym, who declared that he had something of importance to make known to the house, and desired that the outward room should be cleared of strangers, and the outer doors upon the stairs locked. This being done, Pym began. He alluded by way of exordium to the grievances under which the nation laboured. He inferred from these that a deliberate plan had been formed of entirely changing the frame of government. Then he thus continued: 'We must inquire from what fountain these waters of bitterness flow; what persons they are who have so far insinuated themselves into his royal affections as to be able to pervert his excellent judgment, to abuse his name, and wickedly apply his authority to countenance and support their own corrupt designs. Though he doubted not there would be many found of this class who had contributed their joint endeavours to bring this misery upon the nation; yet there was one who both by his capacity and inclination to do evil enjoyed an infamous preeminence; a man who in the memory of many present had sat in that house, an earnest vindicator of the laws, and a most zealous assertor and champion of the liberties of the people: but he had long since turned apostate from those good affections, and, according to the custom and nature of apostates, was become the greatest enemy to the liberties of his country, and the greatest promoter of tyranny that any age had produced.' He then named 'the earl of Strafford, lord-lieutenant of Ireland, and lord president of the council of York, who, he said, had in both places, and in all other provinces wherein his services had been used by the king, raised ample monuments of his tyrannical nature; and that he believed if they took a short survey of his actions and behaviour they would find him the principal author and promoter of all those counsels which had exposed the kingdom to so much ruin.'[*] He then instanced some imperious actions done by him in England and Ireland, some proud and over confident expressions in discourse, and certain passionate advices he had given in the most secret councils of state; adding, says Clarendon, some lighter passages of his vanity and amours; and so concluded, 'that they would well consider how to provide a remedy proportionable to the disease, and to prevent the further mischiefs they were to expect from the continuance of this great man's power and credit with the king, and his influence upon his counsels.'[†]

It is unnecessary to detail here the impeachment of Strafford, which followed, and in which Pym bore so prominent a part. On the 25th of November (1640), at a conference between the two houses in reference to the subject of this impeachment, Mr. Pym made a speech, in which he attempted with considerable though unsuccessful ingenuity to [illegible] the earl of Strafford was guilty of treason, on the [illegible]at 'other treasons are against the rule of the law; [illegible] against the being of the law.' The laws against [illegible] England having been made to protect the king, [illegible]ject, it would be in vain to look in the Statute of [illegible]he 25th Edw. III., st. 5, c. 2, which at that time constituted the English law of treason (the statutes of Henry VIII., making so many new treasons, having been repealed by 1 Mary, c. 1), for any definition or description, or even any mention of that of which Strafford was accused, viz. an attempt to increase the power of the king, and to depress that of the subject. Pym was partly aware of this, and he endeavoured to meet it by saying that this treason of which he speaks 'is enlarged beyond the limits of any description or definition.'

On the 26th of February, 1640, when the articles against Laud had been read, Pym made a powerful speech against him. By a somewhat quaint ingenuity he applies to Laud the expression, 'Spiritual wickednesses in high places.' 'My lords, there is an expression in the Scripture which I will not presume either to understand or to interpret; yet to a vulgar eye it seems to have an aspect something suitable to the person and cause before you. It is a description of the evil spirits, wherein they are said to be spiritual wickednesses in high places; crimes acted by the spiritual faculties of the soul, the will and understanding exercised about spiritual matters concerning God's worship and the salvation of man, seconded with power, authority, learning, and many other advantages, do make the party who commits them very suitable to that description, "spiritual wickednesses in high places."'[*]

He says afterwards, 'It is a miserable abuse of the spiritual keys to shut up the doors of heaven, and to open the gates of hell; to let in profaneness, ignorance, superstition, and error.'

We are furnished by Clarendon with some interesting information respecting the manner of life about this time of Pym and one or two of his illustrious friends. 'When Mr. Hyde sat in the chair,' says Clarendon, 'in the grand committee of the house for the extirpation of episcopacy, all that party made great court to him (Clarendon); the house keeping those disorderly hours, and seldom rising till after four of the clock in the afternoon; they frequently importuned him to dine with them at Mr. Pym's lodging, which was at Sir Richard Manly's house, in a little court behind Westminster Hall, where he and Mr. Hambden, Sir Arthur Hazlerig, and two or three more, upon a stock kept a table, where they transacted much business; and invited thither those of whose conversion they had any hope.'[†]

Clarendon also mentions that they sometimes went out after dinner to ride in the fields between Westminster and Chelsea.

At the conference held between the two houses on the 25th of January, 1641, on presenting to the lords certain petitions which the Commons had received from various parts of the kingdom, London, Essex, &c., Mr. Pym made a speech, concluding with the following remarkable peroration: – 'I am now come to a conclusion, and I have nothing to propound to your lordships by way of request or desire from the House of Commons. I doubt not but your judgments will tell you what is to be done; your consciences, your honours, your interests will call upon for the doing of it; the Commons will be glad to have your help and concurrence in the saving of the kingdom; but if they should fail of it, it should not discourage them in doing their duty. And whether the kingdom be lost or saved (as through God's blessing I hope it will be), they shall be sorry that the story of this present parliament should tell posterity that in so great a danger and extremity the House of Commons should be enforced to save the kingdom alone, and that the House of Peers should have no part in the honour of the preservation of it, you having so great an interest in the good success of those endeavours in respect of your great estates and high degrees of nobility.

'My lords, consider what the present necessities and dangers of the commonwealth require; what the Commons have reason to expect; to what endeavours and counsels the concurrent desires of all the people do invite you: so that applying yourselves to the preservation of the king and kingdom, I may be bold to assure you, in the name of all the commons of England, that you shall be bravely seconded.'[‡]

The Ca[illegible]
class of m[illegible]
suppo[illegible]

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[*] Clarendon, vol. i., pp. 300; i. 800, edit. Oxf., 1826.

[†] Ibid, 96.

[*] Rushworth, part iii., vol. i., p. 199, fol. 1721. 'Speech, &c. of John Pym, Esquire,' 1641.

[†] 'Life,' vol i., p. 90, Oxf., 1927.

[‡] Rushworth, part iii., vol. i., p. 511, fol. 1721.
'A Speech delivered at a Conference with the Lords, January 25, 1641,' 4to., 1641.

Die Martis, 25th January, 1641.
'It is this day ordered by the Commons House of Parliament, that Mr. Speaker, in the name of the house, shall give thanks unto Mr. Pym for his so well performing the service he was employed in by the Commons of this

It will convey some idea of the effect of Pym's eloquence to state that when he made his celebrated speech at Guildhall, the acclamations were so loud at the end of every period, that he was frequently compelled to remain silent for some minutes. So great indeed were his power and popularity, that he received the appellation of King Pym.

The influence of Pym on the counsels of the parliament having exposed him to the chief odium of the opposite party, he some time before his death, in 1643, published a vindication of his conduct, in answer to the reproaches of having been the promoter of all the innovations which had been introduced into the church of England, and the person who had produced all the evils which then afflicted the kingdom. In this paper he declared that he was and ever had been and would die a faithful son of the Protestant religion, without having the least tincture of anabaptism, Brownism, and the like errors; and he justified his consenting to the abolishment of episcopacy. With regard to the reports of his being the author of the differences then subsisting between the king and his parliament, he affirmed. that he never had a single thought tending to the least disobedience or disloyalty to his majesty, whom he acknowledged for his lawful sovereign, and would spend his blood as soon in his service as any other subject in the kingdom. That it was true, when he perceived his life aimed at, and heard himself proscribed as a traitor, he had fled for protection to the parliament, who justly acquitted him and the other gentlemen accused with him of the guilt of high treason. If this therefore had been the occasion of his majesty's withdrawing from the parliament, the fault could not in any measure be imputed to him, or to any proceeding of his, which had never gone further, either since his majesty's departure or before, than was warranted by the known laws of the kingdom and the indisputable power of the parliament.*

In November, 1643, Pym was appointed lieutenant of the ordnance. He died at Derby House, on the 8th of December of the same year, and on the thirteenth of that month he was buried in Westminster Abbey, his body being carried to the grave by six members of the House of Commons. He left several children by his wife, a woman of singular accomplishments, who died about the year 1620.

'As his life, such was his death,' says one who stood by him when he lay on his death-bed.'† He enjoyed, all the time of his illness, the same 'evenness of spirit' which he possessed in health, with an addition of a more 'clear evidence of God's love in Jesus Christ,' and a most ready subjection to God's will, declaring to Marshall that 'it was to him a most indifferent thing to live or die: if he lived, he would do what service he could; if he died, he should go to that God whom he had served, and who would carry out his work by some others.' A little before his end, having recovered out of a swoon, and seeing his friends weeping around him, he cheerfully told them he had looked death in the face, and knew and therefore feared not the worst it could do, assuring them his heart was filled with more comfort and joy, which he found and felt from God, than his tongue was able to utter.

A report was put in circulation by his enemies that Pym died of the loathsome disease called *morbus pediculosus*. However there exists a document, attested by seven physicians, two surgeons, and one apothecary, which states that the disease of which he died was an imposthume in the bowels. And Ludlow mentions that Pym's body was for several days exposed to public view in Derby House, before it was interred, in confutation of those who reported it to be eaten with lice.‡

PYNAKER, ADAM, a celebrated landscape painter of the Dutch school, was born in 1621, at the village of Pynaker, between Schiedam and Delft, and always retained the name of the place of his birth. It does not appear under what master he studied; he went however to Rome for improvement, and remained three years in that city, where he made such good use of his time, that he returned to his own country with the reputation of an excellent painter. He in general preferred a strong morning light, which allowed him to give his trees a more lively verdure. His landscapes are enriched with picturesque ruins or fine buildings, and his figures are spirited and suitable to his subjects. He is much esteemed for the skill with which, by a judicious disposition of the ground, interrupted by breaks, and diversified by hills and valleys, he gives the effect of distance gradually receding from the view as far as the eye can reach. His larger pictures are by no means equal to his smaller ones, which are highly esteemed. They are very scarce, in this country at least; for Dr. Waagen does not appear to have met with even one, in any of the great collections which he visited, and which are described in his work 'On the Arts in England.' In his volume on France he mentions several which he saw in the galleries of Paris. Pynaker died in 1678, at the age of 52.

PYRALLOLITE occurs crystallized and massive. Primary form, according to Levy, an oblique-angled parallelopiped. Cleavage parallel to the two lateral faces of the primary form, and to one of the diagonal planes. Fracture earthy. Hardness, scratches carbonate of lime, and is scratched by felspar. Colour white and greenish; transparent on the edges; lustre resinous. Specific gravity 2·55 to 2·60.

Before the blowpipe, becomes at first black, and afterwards white; swells and fuses on the edges into a glass; with borax gives a transparent glass.

Massive Variety.—Yellowish, in small laminar masses, with white carbonate of lime, red phosphate of lime, and green pyroxene.

Occurs at Storgard, Pargas, Finland.

Analysis by M. Nordenskiöld:—

Silica, 56·62; magnesia, 23·38; alumina, 5·38; lime, 5·58; oxide of iron, 0·99; oxide of manganese, 0·99; water, 3·58.

PYRAMID (πυραμίς), a solid figure contained by a polygonal base, and the triangles formed on the sides of the base by lines drawn from one point to the angles of the base. It is among plane solids what the cone is among curvilinear ones, and its solid content is one-third of that of a prism of the same base and altitude; that is, the number of square units in the base, multiplied by the number of linear units in the altitude, and the product divided by 3, gives the number of cubic units in the content.

The properties of a pyramid are important in the theory of PROJECTIONS, particularly the following:—Every quadrangular pyramid (or pyramid with a quadrangular base) has one section, and one only, which is a parallelogram. To find it, let the vertex be V, and let opposite sides of the base meet in A and B. Then every plane parallel to AVB cuts the pyramid in a parallelogram, one of whose angles is equal to the angle AVB.

PYRAMIDELLA, Lamarck's name for a genus of his *Plicacea*, and placed by M. de Blainville among his *Auriculacea*.

Generic Character.—Animal unknown.

Shell smooth, polished, without an epidermis, conical, elongated, or subturriculate; aperture oval from behind forwards; the outer lip extremely trenchant, toothed internally; the inner lip entirely formed by the tortuous and much plicated columella.

The number of species given in the Tables of M. Deshayes is eleven living and eight fossil (tertiary). *Pyramidellæ terebellata* and *acicula* are there noted as occurring in more than one tertiary formation. The living species inhabit the seas of warm climates in both the Old and New World.

PYRAMIDS. The pyramids of Egypt, especially the two largest of the pyramids of Jizeh, are the most stupendous masses of building in stone that human labour has ever been known to accomplish; and we have records of their having been objects of wonder and curiosity from the age of Herodotus, who was born 484 years B.C., to the present time.

The Egyptian pyramids, of which, large and small, and in different states of preservation, the number is very considerable, are all situated on the west side of the Nile, and they extend, in an irregular line and in groups at some distance from each other, from the neighbourhood of Jizeh, in 30° N. lat. as far south as 29° N. lat., a length of between 60 and 70 miles.

The pyramids of Jizeh are nearly opposite to Cairo. They stand on a plateau or terrace of limestone, which is a projection from the Libyan mountain-chain. The surface of the terrace is barren and irregular, and is covered with sand and small fragments of rock; its height, measured

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house at this conference. And it is further ordered, that Mr. Pym be desired to put the speech he made at this conference into writing, and to deliver it into the house, to the end it may be printed.

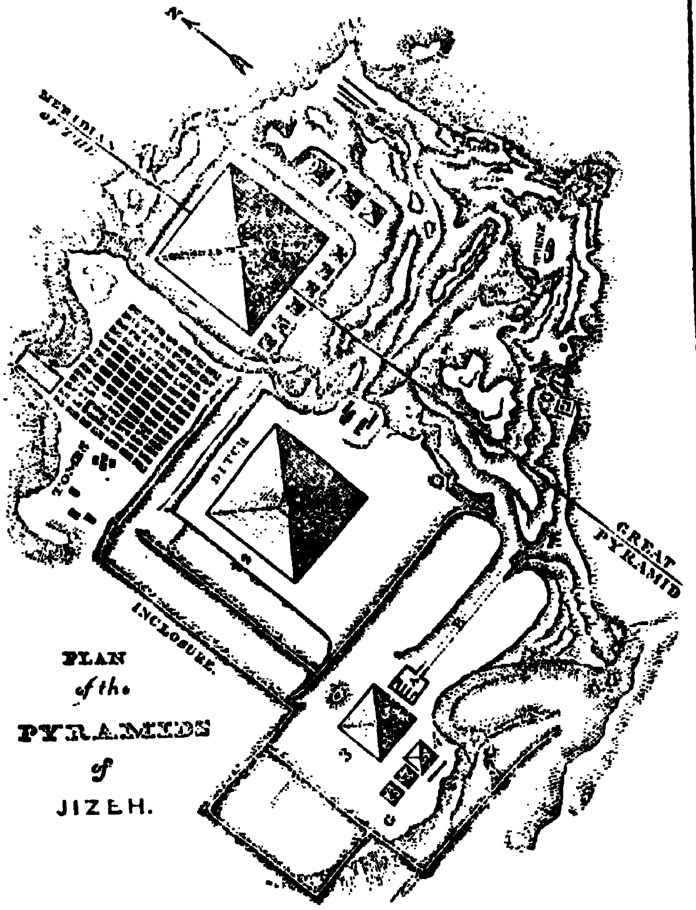
'H. Elsynge, Cler. Parl. D. Com.'

* Rushworth's 'Collections,' part iii., vol. ii., p. 376.

† Stephen Marshall, 'Sermon at Pym's Funeral,' p. 29.

‡ Ludlow's 'Memoirs,' p. 31, fol., edit. London, 1751.

from the base of the great pyramid, is 164 feet above the Nile in its low state, taken at an average of the years 1798 to 1801. The north-east angle of the great pyramid is 1760 yards from the canal which runs between the terrace and the Nile, and about five miles from the Nile itself. The accompanying plan, which is copied from the great French work, 'Description de l'Egypte,' shows the relative situations and sizes of these pyramids, and also the catacombs cut in the rock, the ruined buildings, and the great sphinx.



A, remains of an antient building; B, causeway; D, pyramids, dilapidated: G, pyramids with receding platforms.

Herodotus was informed by the priests of Memphis that the great pyramid was built by Cheops, king of Egypt, about 900 B.C., or about 450 years before Herodotus visited Egypt. He says that 100,000 men were employed twenty years in building it, and that the body of Cheops was placed in a room beneath the bottom of the pyramid, surrounded by a vault to which the waters of the Nile were conveyed through a subterraneous tunnel; a chamber under the centre of the pyramid has indeed been discovered, it is about 56 feet above the low-water level of the Nile. The second pyramid was built, Herodotus says, by Cephren, or Cephrenes, the brother and successor of Cheops; and the third by Mycerinus, the son of Cheops.

It will be seen, from the preceding plan, that there are three large pyramids and several smaller ones. All of them have square bases, and their sides face the cardinal points.

The pyramid of Cheops consists of a series of platforms, each of which is smaller than the one on which it rests, and consequently presents the appearance of steps, which diminish in length from the bottom to the top. Of these steps there are 203, and the height of them decreases, but not regularly, from the bottom to the top, the greatest height being nearly four feet and two-thirds (4·628), and the least rather more than one foot and two-thirds (1·686). The horizontal lines of the platforms are perfectly straight, and the stones are cut and fitted to each other with the greatest nicety, and joined by a cement of lime with little or no sand in it. It has been ascertained that a bed eight inches deep has been cut in the rock to receive the lowest external course of stones. The vertical height, measured from this base in the rock to the top of the highest platform now remaining, is 456 feet. This platform has an area of about 1067 square feet, each side being 32 feet 8 inches. If to this were added what is necessary to complete the apex of the pyramid, the total height would be about 479 feet. Each side of the base, measured round the stones let into the rock, is rather more than 763 feet (763·4), and the perimeter of the base is therefore 3053·6 feet. M. Jomard's figures differ a little from the above, in consequence of his measuring, not the lowest course of stones let into the rock, but the base of the steps which rest upon them. The whole height, according to him, would be nearly 473 feet, and he gives the following dimensions:—

	Feet.
Diagonal of the base . . .	1069·457
Length of the edge, formed by the intersection of two adjacent sides . .	605·893

The following are the angles of the pyramid:—

	°	′	″
Angle of the base of the triangle forming one of the four faces	57	59	40
Angle of the vertex of ditto	61	0	40
Angle of an edge with the diagonal of the base . .	41	57	
Angle formed by two opposite edges . .	97	6	
Angle of the face with the plane of the base . .	51	19	4
Angle of two opposite faces	77	21	50

From this it appears that the faces of the pyramid are not equilateral triangles, as has sometimes been supposed.

The area of the base, measured along the outside of the stones let into the rock, is 64,753 square yards, or about 13¼ acres. This area is about the same as Lincoln's Inn Fields, London, measured by the wall of Lincoln's Inn garden and the sides of the houses within the court-yards. The surface of each face, not including the base let into the rock, is 25,493 square yards; and that of the four faces is consequently 101,972 square yards, or more than 21 acres. The solid content of the pyramid is about 3,394,307 cubic yards, which (not making any deductions for chambers and passages in it) has been estimated to be six times the mass of stone in the Plymouth breakwater. Reckoning the total height at 479 feet, the pyramid would be 15 feet higher than St. Peter's at Rome, and 119 higher than St. Paul's, London.

The entrance to the great pyramid is on the north face, about 47½ feet above the base, and on the level of the 15th step from the foundation. The entrance, which is nearly 21 feet east of the perpendicular which bisects the face, is easily reached by the mass of rubbish at the base, which has chiefly fallen from the top. The passage to which the opening leads is 3 feet 7½ inches square, with a downward inclination of 26°, or 26° 30′ at most. It is lined with slabs of limestone well joined together. This passage leads to another, which has an ascending inclination of 27°. The descending passage is 73 feet long to the place where it meets the ascending passage, 109 feet long, at the top of which there is a platform, with the opening of a well or shaft, which goes down into the body of the pyramid, and the commencement of a horizontal gallery 127 feet long, which leads to the queen's chamber, 17 feet long, 14 wide, and 12 high. But another passage or gallery 132 feet long, 26½ high, and nearly 7 wide, commences at the platform, and is continued in the same line as the former ascending passage, till it reaches a landing-place, from which a short passage leads to a small chamber or vestibule, whence another short passage leads to the king's chamber, which, as well as the vestibule and intermediate passage, is lined with large blocks of granite well worked. The king's chamber is 34¼ feet long, 17 wide, and 19¼ high. The roof is formed of nine slabs of granite reaching from side to side: the slabs are therefore more than 17 feet long by 3 feet 9½ inches wide. This chamber contains a sarcophagus of red granite; the cover is gone, having probably been broken, and carried away. The sarcophagus is 7 feet 6¼ inches long, 3 feet 3 inches wide, and 3 feet 8½ inches high on the outside, the bottom being 7½ inches thick. There are no hieroglyphics upon it.

Mr. Davison, in 1763, discovered a chamber immediately over the king's chamber, which is reached by mounting by a ladder to a hole at the top of the upper ascending gallery; and Colonel Vyse has since (1836-7) discovered three other chambers, also above the king's chamber. All these chambers are from three to four feet longer than the king's chamber, and about the same width, the slabs which are the roof of the one forming the pavement of that which is above it; but none of them is much more than three f[illegible]n They have probably been formed merely to lessen the weight of the mass above the king's chamber.

Captain Caviglia, in 1816, discovered that the entrance passage did not terminate at the bottom of the ascending passage, but was continued downwards in the same inclined plane 200 feet farther, and by a short horizontal passage opened on what appeared to be the bottom of the well. The passage however continued in the same direction 23 feet farther, then became narrower, and was continued horizontally 28 feet more, when it opened into a large chamber cut in the rock, and under the centre of the pyramid. This chamber is about 26 feet by 27. Another passage 55 feet long leads from this chamber, but it appears to terminate abruptly.

The well, which appeared to Mr. Davison and Captain Caviglia to descend no lower than where it was intersected by the descending passage, its depth there being 155 feet, was afterwards cleared out by the French to the depth of 207·75 feet, of which about 145 feet are in the solid rock; so that the base of the pyramid being 164 feet above the low-water level of the Nile, the present bottom of the well is 18 feet 6 inches above the Nile; but the actual bottom does not appear to have been yet reached. The temperature within the body of the pyramid was found to be 81° 5′ Fahrenheit, and in the well it was still higher

Herodotus was informed that the chambers cut in the solid rock were made before the building of the pyramid was commenced. It is evident that it was intended that the pyramid should not be entered after the body or bodies were deposited in it, as blocks of granite were fixed in the entrances to the principal passages in such a manner as not only to close them up, but to conceal them. There are traces however of the pyramid having been entered both by the Romans and the Arab conquerors of Egypt.

As the pyramids consist of a series of platforms, each smaller than the one on which it rests, the height of none of them being so much as five feet, and that height diminishing upwards, it is obvious that the stones could be lifted by manual labour and levers successively from step to step, so as to complete each platform before the next was commenced; but there is a passage in Herodotus respecting the building of this pyramid which is attended with a little difficulty. He says (ii. 124, 125), 'The pyramid was made in the following manner, in the form of steps, which some call *crossæ* (battlements), and others *bómides* (little altars). When they had first built it in this fashion, they raised the remaining stones by machines or contrivances of short pieces of wood. They raised them from the ground to the first tier of steps, and when the stone had ascended to this tier, it was placed on another machine standing on the first row, and from this row it was dragged upon the second row on another machine. As many tiers of stones as there were, so many machines also were there; but, according to another account (for I think it right to give both accounts as they were given to me), they transferred the same machine, it being easily moved from step to step as they raised each stone. The highest parts were accordingly finished first; then the parts next to the highest, and last of all the parts near the ground and the very bottom.'

The 'remaining stones' have sometimes been interpreted to mean casing-stones, similar to those which yet remain on the upper part of the pyramid of Cephren, and by which the whole surface was made smooth. And this indeed would be the only judicious way of putting on such a casing; otherwise, if they began from the bottom, the lower part of the pyramid would be rendered inaccessible, and the stones could only be carried up by external contrivances. There is no doubt that it had such a casing, but the difficulty is, that not a stone that can be proved to have belonged to it now exists either on or about the great pyramid. It is probable that the outer stones, which Herodotus says were highly polished, have been carried off for purposes of building, but it is extraordinary that not one should remain as a solitary witness for the veracity of the Father of History.

Herodotus also informs us, that when the great pyramid was designed, they began by making a causeway for the conveyance of the stone. This causeway, was 3000 Greek feet in length, 60 in breadth, and 48 high at its greatest elevation. It was made of highly polished stone covered with sculptures; and in his opinion was as wonderful a work as the pyramid itself. Of this causeway however there are now no traces, though remains of causeways, along which the [illegible] of the pyramids were probably conveyed, may be [illegible] many places, and particularly in that part of the plan marked B, where there is a causeway about 800 feet long, formed of very large stones, leading to the building A, on the east side of the third pyramid.

The materials of all the pyramids are limestone, and Belzoni is of opinion that part of the stone for the second pyramid was procured immediately on the spot, judging from the manner in which the rock has been cut away round the pyramid. Herodotus certainly understood that all the stone was brought from the mountains near Cairo, where there are indeed antient quarries of great extent; but it seems probable that the greatest part of the materials came from the west side of the Nile. The blocks of granite were of course brought from Syene, which is nearly 500 miles higher up the Nile. The rock on which the great pyramid stands has been found to project at least as high as 80 feet into the body of it. The stones of which it is built rarely exceed nine feet in length and six and a half in breadth; the thickness has been already stated.

The ascent of the great pyramid, though not without difficulty and danger, from the broken state of the steps, is frequently accomplished, and even by females. Belzoni describes the view from the top in terms of enthusiastic admiration.

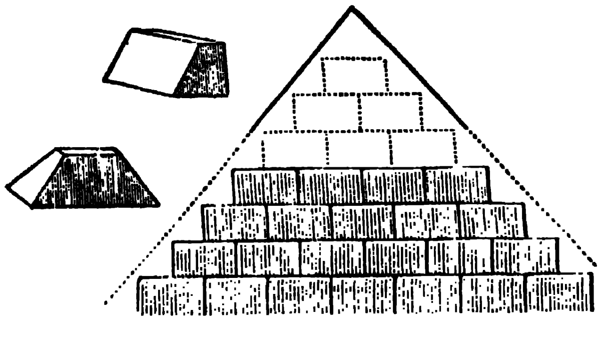
The pyramid of Cephren, the second in size, has the following dimensions, according to Belzoni:—

	Feet.
Side of the base . . .	684
Vertical height . . .	456
Perpendicular bisecting the face of the pyramid	568
Coating from the top to the place where it ends	140

The angle which measures the inclination of each face to the base is 52·5°, and consequently this pyramid has a steeper ascent than the first. This second pyramid does not rise from the natural level of the plateau, but out of an excavation or deep cut made in the solid rock all round the pyramid. The rock in which this excavation has been made is higher than that on which the great pyramid stands, so that both pyramids may stand on the same level, but this does not seem to have been accurately ascertained.

Belzoni, after great exertion, succeeded in opening the second pyramid, and after traversing passages similar to those in the great pyramid, reached the main chamber, which is cut out of the solid rock. It is 46 feet 3 inches long, 16 feet 3 inches wide, and 23 feet 6 inches high. The covering is made of blocks of limestone, which meet in an angular point, and form a roof of the same slope as the pyramid. The chamber contained a sarcophagus, formed of the finest granite, which is 8 feet long, 3 feet 6 inches wide, and 2 feet 3 inches deep in the inside. There were no hieroglyphics on it. Some bones were found in it, which were ascertained to be those of an ox. From an Arabic inscription on the wall of the chamber, it appears that some of the Arab rulers of Egypt had entered this pyramid and closed it again. Belzoni also discovered another chamber in this pyramid.

The ascent of the upper part of the second pyramid is extremely difficult and dangerous. Mr. Wilde, who published, in January, 1840, a 'Narrative of a Voyage to Madeira, Teneriffe, and along the shores of the Mediterranean,' made the ascent; and as his account of the enterprise illustrates the subject of the casing, and is also interesting in itself, we give an extract from it, omitting such sentences or parts of sentences as are foreign to our purpose. 'I engaged two Arabs to conduct me to the summit of the pyramid, one an old man, the other about forty, both of a mould which for combination of strength and agility I never saw surpassed. We soon turned to the north, and finally reached the outer casing on the west side. All this was very laborious, to be sure, though not very dangerous; but here was an obstacle that I knew not how themselves could surmount, much less how I could possibly master: for above our heads jutted out like an eave or coping the lower stones of the coating, which still remain, and retain a smooth polished surface. As considerable precaution was necessary, the men made me take off my hat, coat, and shoes at this place: the younger then placed his raised and extended hands against the projecting edge of the lower stone, [illegible] reached to above his chin; and the elder, taking me up in his arms as I would a child, placed my feet on the other's shoulders, and my body flat on the smooth surface of the stone. In this position we formed an angle with each other, and here I remained for upwards of two minutes, till the older man went round, and by some other means contrived to get over the projection, when, creeping along the line of junction of the casing, he took my hands, drew me up to where he was above me, and then, letting down his girdle, assisted to mount up the younger but less active and less daring climber of the two. We then proceeded much as follows:—One of them got on the shoulders of the other, and so gained the joining of the stone above, which was often five feet asunder; the upper man then helped me in a similar action, while the lower pushed me up by the feet. Having gained this row, we had often to creep for some way along the joining to where another opportunity of ascending was afforded. In this way we proceeded to the summit, and some idea may be formed of my feelings when it is recollected that all these stones of such a span are highly polished, are set at an angle less [more?] than 45°, and that the places we had to grip with our hands and feet were often not two inches wide, and their height above the ground upwards of four hundred feet. A single slip of the foot, and we must all three have been dashed to atoms long before we reached the ground. On gaining the top my guides gave vent to sundry demonstrations of satisfaction, clapping me on the back, patting my head, and kissing my hands. From all this I began to suspect that something wonderful had been achieved; and some idea of my perilous situation broke upon me when I saw some of my friends beneath waving their hats, and looking up with astonishment as we sat perched upon the top, which is not more than six feet square. The apex stone is off, and it now consists of four outer slabs and one in the centre, which is raised up on its end, and leans to the eastward. I do not think that human hands could have raised it thus from its bed, on account of its size and the confined space they would have to work in. I am inclined to think the top was struck with lightning, and the position thus altered by it. The three of us had just room to sit upon the place. The heat was most intense, and the stones so hot that it was unpleasant to sit on them very long, and it would be rather too dangerous an experiment to attempt standing. The descent was, as might be expected, much more dangerous, though not so difficult. The guides tied a long sash under my arms, and so let me slide down from course to course of these covering stones, which are of a yellowish limestone, somewhat different from the material of which the steps are composed, and totally distinct from the rock of the base or the coating of the passages.' The accompanying cut shows the shape of these stones, and how they were placed.



The upper part of the above design shows the coating, and the lower the steps: the upper left-hand figure gives the shape of the casing-stones, and the lower, that of those used at the corners.

The pyramid of Mycerinus, the third of the Jizeh group, is about 174 feet high; the side of the base is 330 feet, and the angle made by the plane of the face with the plane of the base is about 45°. Belzoni says that he found on the north side a considerable number of blocks of granite, which had evidently formed the coating: 'Proceeding yet lower as I cleared away the rubbish, I found that part of the coating still remained in its place down to the base.' This pyramid has not been opened.

The side of the base of the fourth pyramid is probably not more than 130 feet. Two pyramids to the west of the fourth consist each of four receding platforms, similar to the Mexican pyramids, and each of these platforms is ascended by high narrow steps, in which also they resemble the Mexican pyramids. The summit is a platform. Of the three pyramids which appear in the plan on the east side of the great pyramid, the middle one appears to be the pyramid which, as Herodotus tells us, was built by the daughter of Cheops.

There are some large pyramids at Sakkârah. One of them is next in dimensions to the pyramid of Cheops. Each side of the base is about 656 feet, and the height is 339 feet. It is built in receding platforms, and the interior is described by Wilkinson as a sort of hollow dome supported here and there by wooden rafters. At the end of the passage opposite to this dome is a small chamber, on the doorway of which there are some hieroglyphics, but this chamber and passage appear to be of a later date than the rest of the pyramid.

At Dashour there are also some large pyramids. One of them has a base, each side of which is 700 feet, a perpendicular height of 343 feet, and 154 steps. It has a little of the coating remaining on the top. The entrance is on the north face, and there is a principal chamber and some smaller chambers and passages similar to those which we have described in the great pyramid. In another pyramid, almost as large as the preceding, at the height of 184 feet, the plane of the side is changed, and a new plane of less inclination completes the pyramid; for which diminution of the angle there seems to be a sufficient reason, since the lower part of the side appears to make an angle of 70° with the base. This pyramid has been entered, and found to contain chambers and passages similar to the others. Near the first of these pyramids is one built of bricks. The base is a rectangle of 100 paces on one side and 75 on the other. The bricks are made of loam and chopped straw, and are sun-dried.

At Thebes there are some small pyramids of sun-dried brick, in which the central chambers have vaulted roofs. Judging from the style of the frescoes, Wilkinson infers that they date at least as far back as 1230 B.C., and from other buildings he concludes that brick vaults and arches were constructed by the Egyptians as early as 1540 B.C.

Herodotus informs us that in the lake Mœris, 'about the middle of it, there are two pyramids, each rising 300 feet above the water. The part that is under the water is just the same height. On the top of each is a colossus of stone, seated in a chair.' It is probable that these pyramids were built on an island in the lake, and that he was misinformed as to the depth under the water.

There are numerous pyramids in Nubia, perhaps eighty or more, but they are generally small. Many of them have propyla attached to one side, as if forming the entrance to the building. There are three groups of such pyramids at a place called Assur, near the Nile (about 17° N. lat.). They are built of sandstone, and the propyla are adorned with sculptures after the Egyptian fashion. They do not appear to have been entered. The sides of most, perhaps all, of the Nubian pyramids do not face the cardinal points. There is a group of pyramids at a place called Nourri, in lat. 18·25° N., a few miles north of Jebel Barkal, on the opposite (the east) side of the river. The largest of these pyramids contains within it another of a different date, stone, and architecture. The inner pyramid is seen in consequence of part of the outer one having fallen off. The base line is about 155 feet, and the height about 104 feet.

But buildings of this description are not confined to Egypt and Nubia. The temple of Belus (the Birs Nemroud), and the Mujelibè, at Babylon, were pyramidal buildings. The perimeter of the base of the Birs Nemroud is 762 yards. The Mujelibè has an oblong base, the sides of which face the cardinal points. The northern side is 200 yards, the southern 219, the eastern 182, and the western 186. The highest part of it which remains is 140 feet. There are passages in it, and a hollow shaft 60 feet square. Coffins and skeletons have been discovered in it. [Babylon.]

Xenophon, in his account of the retreat of the ten thousand, speaks of a stone pyramid which he saw near the Tigris, about forty-five miles south of the present Mosul, the height of which he estimated at 200 feet. There are some temples of the pyramidal form near Benares, in the East Indies. But next to those of Egypt the most extraordinary pyramids now existing are those of Mexico. At Teotihuacan, eight leagues north-east of the city of Mexico, there are two large pyramids, surrounded by several hundred small ones placed in lines running due north and south, and east and west. The two large pyramids are formed of clay mixed with small stones, but they were cased with a sort of porous amygdaloid. They consist of four receding platforms, each of which is formed into a number of small steps, the edges of which were visible when Humboldt visited them. A colossal stone statue, covered with plates of gold, stood on the summit of each, but the soldiers of Cortez carried off the gold, and the statues were broken. The largest of the small pyramids is not above thirty feet high. The great pyramid of Cholula in Mexico has a base each side of which is 1440 feet, and the area of the base is therefore upwards of forty-seven acres and a half, more than three times the base of the great pyramid of Jizeh, but the present height is much less, being only 177 feet. The platform on the top has an area of more than 50,000 square feet, and a church has been built in the centre of it. This pyramid is built of alternate layers of clay and sun-dried bricks. [CHOLULA.] A small pyramid, built entirely of well-hewn stones of a remarkable size, has been discovered, which had escaped the notice of the early Spaniards. It is 59 feet high, and each side of the base is 82 feet. The casing of the platforms is adorned with hieroglyphic sculptures. It is to the east of the pyramid of Teotihuacan. Several other pyramidal buildings were discovered in Mexico by Captain Dupaix, between 1806 and 1808, in three successive expeditions which were prosecuted under the authority of the Mexican government. The Mexican pyramids, like those of Egypt, and the Babylonian and the Indian, have the four sides facing the four cardinal points; but this rule has not been observed in building the Nubian pyramids.

The East Indian, the Babylonian, and the Mexican pyramids appear to have been partly religious and partly sepulchral; but there is no trace of evidence to show that the Egyptian pyramids were built for any purpose but that of preserving the bodies and perpetuating the names of those who built them. Most of them were cased in such a manner as to render the ascent difficult and dangerous, if not impossible. The passages to the sepulchral chambers, and indeed to all the chambers, were carefully closed and concealed, and nothing has been found in any of them but coffins and their mouldering contents. As to their having been built for astronomical purposes, about which there has been much discussion, in addition to there being nothing to prove that they ever were used for such purposes, it may be asked, why build two of such enormous size so close together, when one would have answered the purpose, and why build so many of all sizes?

The preceding account has been abridged from the chapter on the pyramids in the 'Egyptian Antiquities,' vol. ii., in the 'Library of Entertaining Knowledge,' with some trifling alterations and additions. See also Savary's 'Letters on Egypt,' Lond., 1799; 'Description de l'Egypte,' vol. v., Paris, 1829; Wilkinson's 'Topography of Thebes and General View of Egypt,' London, 1835; Wilde's 'Narrative,' Dublin, 1840.

PYRARGILLITE occurs in four sided prisms, with bevelled edges and massive; frequently traversed by chlorite. Colour black or blue; in the former case shining, in the latter dull. Emits an argillaceous odour when heated. Dissolves entirely in nitric acid.

It is found in granite near Helsingfors in Finland.

Analysis by Nordenskiöld:—Silica, 43·93; alumina, 28·93; xide of iron, 5·30; magnesia, 2.90; potash, 1·05; soda, 1·83; owater, 15·47.

PYREICUS, a Grecian painter of uncertain age and country, but he most probably lived shortly after the time of Alexander. He was the head of the antient *genre* painters (peintres du genre bas), or of those who practised in the lower classes of art, formerly so prevalent in the Netherlands, and which the Greeks termed Rhyparography (*ῥυπαρογραφία*). According to Pliny (xxxv. 10·37), Pyreicus stood without a rival in this line of art, and though in an humble style, he attained the greatest fame. He painted barbers' shops and coblers' stalls, shell-fish and eatables of all sorts, and the like: on this account he was called by the Greeks Rhyparographos, that is, literally, 'dirt-painter.'

PYRENEES, a range of mountains extending from the Mediterranean Sea to the Bay of Biscay, and constituting a natural barrier between France and Spain. They were well known to the antients, especially to the Romans, within the boundary of whose empire they were comprehended. The etymology of the name is uncertain: it is written by Strabo usually in the singular, Puréné (*πυρήνη*);* by Cæsar it is written in the plural form, Pyrenaei Montes; by Pliny indifferently in the singular or plural; and Lucan has given it (*Pharsalia*, i. 689) in the Greek form, Pyréné. Historically these mountains are associated with the celebrated march of Hannibal and the warfare of Cæsar against the Pompeians in Spain. In a later period they formed the limit of the Frankish conquests under Clovis, but were passed by the ambition and power of Charlemagne, who however lost his rear-guard among their defiles. In the middle ages they were crossed by the French in their successive wars in Spain; and by Edward the Black Prince in his expedition to support Peter the Cruel; and in modern times they were the scene of severe conflict in the Spanish wars of Napoleon, especially when the French were driven out of the Peninsula by the Duke of Wellington, in the winter campaign of 1813-1814.

The Pyrenees are usually considered as occupying the limits which we have assigned, and as constituting an insulated chain; but this is hardly correct. On the east, their ramifications are connected with those of the Cévennes [CEVENNES]; and on the west, the prolongation of the Pyrenees forms the mountains of Guipuzcoa, Biscay, Asturias, and Gallicia, the loftiest summits of which all but equal in height those of the Pyrenees proper, and the extremities of which terminate in the capes Ortegal and Finisterre, and the other headlands of the north-west of Spain. Our present article will however comprehend a notice of that part only of the system to which the name of Pyrenees is usually applied.

The area occupied by these mountains is comprehended between 42° 10′ and 43° 20′ N. lat., and between 3° 20′ E. and 2° 0′ W. long. The length of the chain from Cape Creux, or Creuz, near the town of Rosas, or Roses, in Catalonia, on the coast of the Mediterranean, to the port of Passages in Guipuzcoa, is about 270 miles in a straight line from east by south to west by north. The breadth varies: it is greater near the central part of the chain than toward the extremities. Between Tarbes and Jaca, and again between Pamiers and Urgel, the breadth may be stated in round numbers at 60 miles; between La Bastide de Clarence, near Bayonne, and Pampeluna, near the western extremity, it may be estimated at 40 to 45 miles; and between Collioure and Figueras, near the eastern extremity, it is diminished to about 20 miles.

The Pyrenees pass along the border of the following districts of France, enumerated for the most part in their order from east to west:—Le Valespir, Le Conflent, La Cerdagne Française (to the north of which are Le Capsir and Le Donezan), and the valley of Carrol, all in the province of Roussillon, which now forms the department of Pyrénées Orientales; the county of Foix and the district of Couserans, the latter in the province of Languedoc, and both now in the department of Arriège; Le Haut Comminge (including the district properly so called, and the valleys of Betmale, Biros or Birosse, Luchon, Larboust or L'Arbouste, Oeil, and Louron), now divided among the three departments of Arriège, Haute Garonne, and Hautes Pyrénées; Les Quatre Vallées, or the four valleys of Barousse, Aure, Neste, and Magnoac, forming part of the county of Armagnac in Gascogne; and the valleys of Campan, Barèges, Lavedan, and Azun, in the county of Bigorre, all now included in the department of Hautes Pyrénées: the valleys of Asson, or Ossau, Aspe, and Barreton, in Béarn; the Pays des Basques (including the Pays de Soule, Basse Navarre, and the Pays de Labour), all in Gascogne, and all now included in the department of Basses Pyrénées.

In Spain the Pyrenees pass through Catalonia, in which are included Spanish Cerdagne, and the valleys of Andorre, Paillass or Paillas, and Arran, with a number of smaller valleys; Aragon, including the valleys of Venasque, Gistain or Justau, Bielsa, Broto, Canfran, Echo, and others; and Navarre, including the valleys of Roncal, Ahescoa, Roncevaux, or, as the Spaniards write it, Roncesvalles (where Charlemagne's rear-guard was cut off by a combination of enemies), Erro, Henqui, Lanz, Bastan, and Lerin. Andorre, a valley locally in Catalonia, has existed for a thousand years, almost unnoticed, as an independent republic. [ANDORRE.]

The range of the Pyrenees may be regarded as consisting of two parts, both having the same general direction, but not forming one continuous line: the point of dislocation is near the head of the Garonne; from thence to the Mediterranean the principal ridge is more advanced toward the north than between the head of the Garonne and the Bay of Biscay. The point at which the two parts of the chain approach each other is occupied by a group of mountains which unite them to one another. The Spanish or southern slope of the Pyrenees is generally considered to be steeper than the northern or French side: the ascents on the Spanish side are invariably more rugged and difficult; and while on the south side of Mount Perdu and other lofty mountains the summits rapidly diminish in height, there are several peaks on the north side which scarcely yield to Mount Perdu itself in elevation. The French valleys generally ascend toward the main ridge by a succession of steps and terraces.

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* The name Πυρήνη occurs in Herodotus, ii. 33, but it is there given to a city near which the river Ἴστρος (the Danube) has its source.

From each side of the principal range a number of smaller branches are thrown off, forming, as it were, buttresses to the principal range, and enclosing valleys between them. These lateral branches are thrown off at the points where the main ridge rises into lofty summits; while the heads of the valleys are marked by depressions, which constitute the natural passes between one side and the other of the mountains. Towards the extremities of the Pyrenees, especially towards the eastern extremity, these depressions are called 'cols' (*i.e.* necks), as in the Alps: in the central part, and, in some cases, toward the western extremity, they are more commonly designated 'ports.' Other terms of similar meaning are also used occasionally. The principal branches thrown off on the northern side are the Corbières, near the eastern end of the range, which connect the Pyrenees with the Cevennes; and a range, without name, which separates the basins of the Adour and the Garonne.

All the great valleys of the Pyrenees are transverse. The head of the valley is usually at a 'col' or a 'port,' and the valley extends twenty, thirty, or even forty miles toward the north or south, bounded by the lateral branches the mountains. The longest valleys, as that of the Garonne, and the valley of Lavedan, which is watered by the Gave de Pau, are near the centre of the great range. There are some valleys which have their direction parallel to the principal range: and though not equal in extent to the transverse valleys, yet some of them are near twenty miles in length. Sometimes the mouth, or opening of the valley into the plain, is open or broad; in other cases the valleys have narrow entrances. Many of them in their course present a succession of basins, or circular hollows, called by the mountaineers 'oules,' *i.e.* pots or boilers,* through which the stream which waters the valley winds slowly, assuming a character in keeping with the quiet scenery of these secluded spots. These basins are usually elevated one above the other, and they communicate by narrow and deep ravines, or by a slope or descent more or less steep. In the upper part of the valleys, where these basins are more frequent and more perfect in their form, they often contain lakes. These lakes are numerous on the French or northern side of the mountains; on the Spanish or southern side they are seldom seen. Some of them are in very elevated sites. Malte-Brun (*Géographie Universelle*) enumerates eight which are at an elevation of above 2000 metres (= 6557 English feet). When they are of such elevation as to be surrounded with glaciers, they are commonly frozen. The lake at the 'port' of Oo (elevation 8800 feet) is covered with ice all the year round; the lake of Mont Perdu (elevation 8393 feet), and the lakes of Estom Soubiran, in the valley of Cauteretz, are covered with ice until the end of August. The most elevated lake given by Malte-Brun is that of the Pic-du-Midi (8813 feet).

The basins described above seldom if ever exceed eight miles in length by three or four in breadth. They are always at the point of junction of several valleys or gorges, and their extent bears a proportion to the number of valleys or gorges which open into them. They are found also in the elbows formed by the alteration in the direction of a valley. Their soil is alluvial, and often marshy or composed of peat. The manner in which the streams that water them break away through deep and narrow gorges is a proof that they have been antiently the beds of lakes, the water of which has been drained off by bursting through the rocky barrier by which they were surrounded.

The sides of the mountains which skirt the valleys seldom rise with an unbroken slope to their summit, but consist of a succession of slopes of varying inclination, with small plains or terraces intervening. Those terraces or plains in the mountains which rise on one side of a valley usually correspond in elevation and in the strata which compose them to those of the mountains on the other side. This arrangement is observable in the upper districts of the valleys; in the lower districts, where the mountains are of inferior height, they frequently consist of an unbroken slope from their base to their summit. At the head of some of the valleys is found one of the hollows or basins, locally termed 'oules,' surrounded by walls of almost perpendicular rock called 'cirques,' and sometimes 'amphitheatres.'

The line of perpetual congelation in the Pyrenees appears not to have been ascertained. Ramond fixed it at from 1350 to 1400 toises (8600 to 9000 feet English measure); but on some mountains, as on the Pic-du-Midi of Bigorre, which exceeds this limit (9544 feet), the snow melts in August. Malte-Brun gives the line of perpetual congelation at 2826 mètres (=9266 feet) on the northern slopes, and 2534 mètres (=8308 feet) on the southern. The climate in the neighbourhood of the Pyrenees varies considerably. It is warmer at the extremities, because of the inferior height of the mountains and the proximity of the sea, this is especially the case at the eastern extremity, where the olive grows luxuriantly. The winters are short, and in the lower valleys snow rarely lies more than a day or two. In the upper valleys the climate is more rigorous. The pine and the fir, the box, the rhododendron, the Alpine rose, and a variety of other trees and shrubs, grow on the sides. The summers are very warm, and vegetation in all the valleys is very luxuriant. Thunder-storms are frequent, and are accompanied by rains, which cool the air greatly.

Numerous streams rise both on the northern and the southern side of the Pyrenees. Those on the southern side, except a few near the eastern extremity, flow into the Ebro. The Arga, which passes Pampeluna, the Iratie, the Esca, and several others are received by the Aragon, which rises near the Pic-du-Midi, and flows westward into the Ebro at Alfaro, between Calahorra and Tudela. The Gallego, or Gaillego, receives a number of mountain-streams, and joins the Ebro below Saragossa. The Cinca and the Segre, which unite and flow into the Ebro near Mequinenza, receive all the drainage of the southern slope from the neighbourhood of Barèges to that of Mont Louis: several of the tributaries of these rivers, as the Ara, the Essera, the Noguera or Nogurra, the Ribagorsana, and the Noguera Pailleressa, are considerable streams. The Cardonner, the Fluvia, the Ter, and some others near the eastern extremity flow immediately into the Mediterranean.

The waters of the northern slope near the western extremity chiefly flow into the Adour. The Bidassoa indeed flows directly into the Bay of Biscay, but it is an inconsiderable stream, and would be of no importance but from the accidental circumstance of its forming the boundary between France and Spain. The Adour itself rises in the valley of Campan above Bagnères de Bigorre, and all the streams to the westward, as far as the Nive and the Hourepeleco, which rise in the neighbourhood of St. Jean-Pied de-Port, fall into it. Eastward, from the source of the Adour to the source of the Arriège in the valley of Carrol, near the town of Ax, the waters all fall into the Garonne. The Garonne itself rises at the head of the valley of Arran, just at the point where the two portions of the principal range of mountains approach each other. Mont Maladetta, or Maudit (Maledictus, 'accursed'), is on the south side of this valley. The Spanish river the Noguera Pailleressa rises very near to the source of the Garonne, and flows in an opposite direction. The streams eastward of the Arriège fall into the Aude, which waters Carcassonne, except the Tech, the Tet, and the Gly, which fall immediately into the Mediterranean.

There are numerous mineral springs in the neighbourhood of the Pyrenees; several of those on the French side are of considerable repute. Those of Bagnères de Bigorre, Bagnères de Luchon, and Barrèges, are noticed elsewhere. [BAGNERES DE BIGORRE; BAGNERES DE LUCHON; BARREGE.] Those of St. Sauveur, in the valley of Lavedan; of Cauterets or Cauteretz; of Eaux Bonnes, in the valley of Ossau; of Eaux Chaudes, in an adjacent valley; of Ax, in the valley of the Arriège; of Aleth, in that of the Aude: and some others, are also of considerable note.

In the higher Pyrenees glaciers are of frequent occurrence; they are found adjacent to the loftiest peaks. Avalanches also occur, as in the Alps. The glaciers of the Pyrenees are found on the slopes of the loftier mountains, not occupying deep gorges or valleys, as in the Alps; neither are they, as in the latter mountains, contiguous, but separated frequently by considerable intervals. They are frequently traversed by deep fractures or chasms. Glaciers are found only in one part of the mountains between the valleys of Arran and Ossau, and for the most part on the northern slope of the mountains. The principal are those of Maladetta, Crabioules, Mont Perdu, Brèche de Roland, Viguemale, and Neouvielle, which take their names from the peaks or depressions adjacent.

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* The word 'oule' (*houle* or *ouil*) means a large pot or kettle, and appears to contain the same element as the Latin 'olla.'

The recesses of the Pyrenees are the haunts of the izard, a variety of the chamois, of smaller size and brighter colour, possessing, it is probable, less strength and agility than the chamois of the Alps. The bear and the wolf are also found, but the bear is not so ferocious as that of Switzerland. The slopes of the mountains afford pasturage in summer to numerous flocks, which are driven thither from the plains or lower slopes where they pass the winter. Iron, copper, and lead and silver mines are wrought, and fine statuary and other marble, including some of the most beautiful varieties, is quarried. The shepherds and other mountaineers are a fine intelligent race of men, especially those on the southern or Spanish side, and, on the north side, the Basques, who inhabit the western part of the chain. An unhappy and despised race of men, disfigured, like the mountaineers of Valais in the Alps, by wens or goîtres, are found in the Pyrenees, where they are called Cagots. They were formerly held in abhorrence, and retained in a state of the utmost degradation and misery. With the general advance of comfort and civilization, and the prevalence of a better spirit, these deformities are becoming less frequent.

We subjoin a table of the elevation of the principal summits and depressions (cols, or ports) of the Pyrenees, and of some of the towns or other inhabited places near or amidst them:—

SUMMITS.

(We have given only those which exceed 9000 feet.)

Summit.	Department or Province.		Feet.
Le Canigou	Aude		9,132
Pic Peyric, or Prigue	Arriège and Pyrénées Orientales		9,037
* Pic Lanoux	Pyrénées Orientales		9,284
* Pic Pedrous	Ditto		9,133
* Pic de Fontargente, or Fonte Argente	Arriège		9,164
* Pic de la Serrère	Ditto		9,592
* Pic du Port de Seguier, or Siguier	Ditto		9,525
* Montcalm	Ditto		10,513
* Estats	Ditto	C. A.	10,611
* Montvallier	Ditto		9,120
* Pic de Montouléon, or Tuc de Mauberme	Ditto		9,124
Montarto, or Pic de Rious	Valley of Arran in Catalonia		9,557
* Crabioules, or Carabioules	Haute Garonne		10,450
* Tuque de Maoupas	Ditto		10,228
Pic Fourcanade	Valley of Arran in Catalonia	C. A.	10,030
Pic de Néthou, or Nétou, or Anethou, the highest summit of Mount Maladetta and of the whole range of the Pyrenees	Ditto		11,318
Inaccessible ridge to the west of the Pic de Néthou	Ditto		10,304
* Pic Poset, or Las Posets, otherwise La Punta de Lardana	Aragon		11,172
Pic Quairat	Haute Garonne		10,038
Pic de Montarouye	Ditto		9,107
Pic des Hermittans	Ditto		9,842
* Pic de Batoa, or Biedous	Hautes Pyrénées		9,918
Pic d'Arré, upper	Ditto		9,525
Ditto, lower	Ditto		9,465
* Pic de Baroudes	Ditto		9,703
Mont Perdu	Aragon		11,264
Cylindre du Marboré	Ditto		10,950
* Pic de la Cascade	Hautes Pyrénées		10,646
* Tour du Marboré	Ditto		9,933
Summit of Le Pimené	Ditto	M. B.	9,380
* Le Taillon	Ditto		10,443
* Troumouse	Ditto		10,399
Pic d'Aiguillon	Ditto		9,646
Commencement of the cascade of Gavarnie	Ditto		10,385
Pic de Campbiel, or Cambielle	Hautes Pyrénées		10,513
Pic Long	Ditto		10,488
Pic de Neouvielle	Ditto		10,235
Pic d'Arbizon	Ditto		9,247
Pic-du-Midi de Bigorre	Ditto		9,432
* Viguemale	Ditto		10,900
Pic de Badescure	Ditto		10,228
* Pic d'Arrieu Grand	Ditto		9,760
* Pic or Som de Soube	Basses Pyrénées		10,178
* Pic-du Midi d'Ossau	Ditto		9,696
Pic d'Aule	Ditto		9,532

DEPRESSIONS.

Summit.	Department or Province.		Feet.
Col de Puymoreins	Arriège	M. B.	6,295
* Port de Rat	Ditto		7,403
Port de Lherz, or Lers	Ditto		4,927
Col de la Couillade	Ditto		6,434
Port de Viella	Valley of Arran in Catalonia		8,145
* Portillon de Burbe	Haute Garonne		4,079
Port de la Picade	Aragon		7,872
* Port de Venasque	Haute Garonne		7,841
* Port de la Glère, or de la Claire	Ditto		7,529
* Port d'Oo	Ditto		9,753
Port de Peyresourde	Ditto		4,991
* Port de Clarabide	Hautes Pyrénées	C. A.	9,849
* Port de Lapez	Ditto		8,008
* Port de Plan	Ditto		7,289
* Port Viel or Vieux	Ditto		8,322
* Port de Pinède, or Estaubé	Ditto		8,176
* Brèche de Tuque Rouye	Ditto		9,417
Col de Pimené, or Brèche d'Allans	Ditto		8,176
* Brèche de Roland	Ditto		9,766
* Port de Gavarnie	Ditto		7,423
Port de Campbiel, or Cambielle	Ditto		8,442
Col de Tourmalet	Ditto		7,131
Col de Lavasse, or L'Avase	Ditto	M. B.	5,936
Col de Loubie	Ditto	M. B.	5,672
Port de Canfranc, or St. Christine	Aragon		6,713
* Port de Roncevaux	Navarre	C. A.	5,771
* Port de Arrüiz	Ditto	C. A.	4,347

The summits and depressions marked thus * are on the ridge along which runs the boundary of France and Spain. Pic means peak or summit; tuc or tuque, in the patois of the district of Couserans, has the same meaning. Col, port, portillon, and brèche all mean a depression at the head of a valley. These cols or ports form the passages by which the peasantry pass from one valley to another. They are frequented by contrebandiers, or smugglers, a bold and hardy race of men, chiefly Spaniards, remarkable for the coolness which they exhibit in the critical circumstances to which their mode of life frequently exposes them. The most important of these passes are the Col de Pertus commanded by the fortress of Bellegarde, through which runs the road from Perpignan to Barcelona, practicable at all seasons, and for vehicles of every kind; the Col de la Perche, commanded by the fortress of Mont Louis, communicating between French and Spanish Cerdagne; the Port de Salo, through which runs the road from Toulouse and St. Girons to Lerida; the Port de Viella, by which communication is kept up between the valley of Arran and the rest of Spain; the Port de Canfranc, through which runs the road from Oléron by the valley of Aspe to Jaca; the Port of Orisson and the Port of Roncevaux, through which runs the road from St. Jean-Pied-de-Port to Monreal; and the Port de Maya, communicating between Bayonne and Pampeluna. Several of these are not given in our list. The main road from Paris, Bordeaux, and Bayonne to Madrid is near the sea, at the western extremity of the chain.

Towns and other inhabited places.		Feet.
Céret (town), Pyrénées Orientales		317
Arles (town), do.		899
Montferet (village), do.		2539
Mont Louis (town), do.	C. A	5210

Towns and other inhabited places.		Feet.
Suc (village), Arriège		3084
Sem (village), do.		3116
Foix (town), do.		1216
Tarascon (town), do.		1501
St. Paul de Jarrat, or Jorat (village), Arriège		1418
Massat (town), Arriège		1919
St. Girons (town), do.		1336
Angoumer (village), do.		1469
Le Maz d'Azil (town), do.		855
Sainte Croix (village), do.		798
Viella, chief town in the valley of Arran, in Catalonia		2863
St. Beat (town), in the valley of the Garonne, Haute Garonne		1748
Bagnères de Luchon (town), Haute Garonne	 M. B.	1989 2013
Hospital of Bagnères de Luchon, do.		4408
Cabin at the Plain des Estangs at the foot of Maladetta, valley of Arran in Catalonia		5839
Hospital of Venasque, Aragon		5542
Village of Venasque, do.	M. B.	3829
St. Lary (village), Hautes Pyrénées		2533
Plan d'Arragnouet (village), do.		4332
Hospital of Plan, Aragon		4864
St. Juan, chief town of the valley of Gistain, Aragon		3629
Bielsa (town), Aragon		3255
Notre Dame de Pinède, nearest habitation to Mont Perdu, Aragon		4224
Notre Dame de Héas, Hautes Pyrénées		4687
Hospital of Boucharo, Aragon		4693
Gavarnie (village), Hautes Pyrénées		4855
Gedre (village), do.		3458
Baths of St. Sauveur do.		2502
Lus, or Luz (town), do.		2400
Barèges (town), do.	 M. B.	4167 4236
Pierrefittes (village), do.		1647
Cauteretz (town), do.	M. B.	3184
Argelez (town), do.		1526
Lourde (town), do.		1336
Tarbes (town), do.	 M. B.	950 990
Bagnères de Bigorre (town), do.	M. B.	1820

The chief authority for the above tables is Mr. Erskine Murray. A few are taken from Malte-Brun (M.B.), and the 'Companion to the Almanack (C.A.) for 1833.' The elevations in the latter are taken from Reboul and Vidal, Charpentier, Bory de St. Vincent, and others. The heights in Malte Brun are given in mètres, here reduced to English measure, at the rate of 1 mètre = 3·279 feet, or 1 foot = ·305 mètre. Mr. Murray's table we have ascertained to be reduced from that of Charpentier at the rate of 6 feet 4 inches to the toise.

Our chief authority for this sketch of the Pyrenees has been the account of that mountain-range translated from Charpentier's *Essai sur la Constitution Géognostique des Pyrénées*, and subjoined to the Hon. James Erskine Murray's *Summer in the Pyrenees*, 2 vols. 8vo., 2nd edit., London, 1837; compared with Malte-Brun, Balbi, and the *Dictionnaire Géographique Universel*, Paris, 1831.

PYRE'NE'ES, BASSES, a department in the south of France, bounded on the north by the department of Landes, on the north-east by that of Gers, on the east by that of Hautes Pyrénées, on the south and south-west by the provinces of Navarre and Guipuzcoa in Spain (from which it is separated by the Pyrenees), and on the north-west by the Bay of Biscay. Its form is tolerably compact: the greatest length is from east to west, from the village of Montaner near Vic Bigorre (in Hautes Pyrénées) to the mouth of the Bidassoa (which separates France and Spain), 88 miles: the greatest breadth is from north to south, near the eastern side of the department, from near the town of Garlin to the crests of the Pyrenees, near the source of the Gave d'Azun, which flows into the Gave de Pau, about 54 miles. The area is estimated at 2901 square miles, being considerably above the average area of the French departments, and about equal to the conjoint areas of the three English counties of Gloucester, Worcester, and Warwick. The population in 1831 was 428,401; in 1836 it was 446,398: showing an increase in five years of 17,997, or more than 4 per cent., and giving 154 inhabitants to a square mile. In amount of population it is considerably above the average of the French departments; but in density of population it is somewhat below the average; and is, in both respects, surpassed by the united English counties with which we have compared it, in the proportion of two to one. Pau, the chief town, is on the right bank of the Gave de Pau, about 402 miles in a straight line south-south-west from Paris, or 497 miles by the road through Orléans, Vierzon, Châteauroux, Limoges, Périgueux, Bordeaux, Langon, Bazas, Roquefort, and Aire; in 43° 17′ N. lat. and 0° 23 E. longitude. [PAU.]

The southern border of the department is formed by the Pyrenees. The lateral branches of these mountains run from south to north, gradually subsiding into the plain which is watered by the Adour and its tributaries. The elevation of this part, the western extremity, of the Pyrenean range, is, as the name of the department indicates, lower than the central parts. Scarcely any of the summits exceed 9000 feet: we are not aware of more than three; the Som de Soube, on the principal ridge, between the valleys of Azun and Ossau; the Pic-du-Midi of Ossau or Ossan, at the source of the Gave d'Ossau, both in the south eastern corner of the department; and the Pic d'Aule, in the same neighbourhood. [PYRENEES.] The Pic d'Anie, on the principal ridge of the Pyrenees, between the sources of the Gave d'Aspe and the Seison or Soisson, has an elevation of 8398 feet: the mountain of Orhi or Hory, on the same ridge farther westward, has an elevation of about 6530 feet: Mendibelsa, in the canton of St. Jean-Pied-de-Port, has an elevation of 3734 feet: Abady, at the source of the Nive, of 4790 feet; and Hausa, between the valley of Baigorry in the south-western part of the department, and the valley of Bastan in Spain, of 4224 feet. The chief passages across this mountain-frontier are the main road from Paris by Bordeaux and Bayonne to Madrid, which crosses the boundary at the western foot of the mountains near the sea; the Port de Maya, between Bayonne and Pampeluna, capital of Navarre; the Port de Roncevaux, or Roncesvalles, between St. Jean-Pied-de-Port and Monreal and Pampeluna; and the Port de Canfranc, between Oléron and Jaca. [PYRENEES.]

The Pyrenees consist of primitive rocks (especially granite mingled with gneiss), which occupy however but a small space in this department. The transition rocks (grauwacké, grauwacké slate, clay-slate, and transition limestone) form the principal component part of the mountains, skirting the nucleus of primitive rocks by which they are supported. The secondary formations, especially the new red-sandstone or red-marl formation, and the Alpine limestone which overlies it, form the predominant rocks; the former is observed in the higher part of the mountains, where it usually exceeds the transition rocks in elevation; the latter appears in the lower slopes and at the base of the mountains, extending northward in several parts to the banks of the Adour and the Gave de Pau. The immediate vicinity of these rivers, and the north-eastern part of the department, which extends across the Gave de Pau, are occupied by the tertiary formations. Masses of secondary trap rocks are found in the lower part of the valleys of Baigorry, Cize, and Laurhibare, watered by the branches of the Nive; in that of Soule; in those of Baretous, Aspe, and Ossau, watered by the tributaries of the Gave d'Oleron; and in the valley of Asson, watered by a feeder of the Gave de Pau. The formations of the cretaceous group are found on the flanks of the Pyrenees, but so altered in their mineralogical character by their vicinity to the granite, that it requires a careful examination of their characteristic fossils to distinguish them, and most writers have omitted to notice their occurrence.

The mineral wealth of the department is not considerable. There were formerly celebrated copper-mines in the transition formations of the valley of Baigorry. It has been said that mines were worked in this valley by the Romans, at any rate they were successfully worked for a considerable time in the middle ages. After having been given up, the working of them was resumed about the middle of the last century; but after occasioning immense loss to the proprietors and to the companies which successively undertook to work them, they were again abandoned. Iron-ore is obtained in the same valley. There were in the department, in 1834, six establishments for the manufacture of iron, comprehending three furnaces for making pig-iron, and eleven forges for the production of wrought-iron. The fuel employed in three establishments was charcoal alone; in the rest charcoal with other fuel. The mountains afford granite, freestone, and slate, in which some quarries are worked. There are several mineral springs.

The department belongs altogether to the basin of the Adour. The general slope of the soil is to the north-west. A number of rapid mountain-streams flow down from the Pyrenees and fall into the Adour, which has the lower part of its course on the border of the department. Of these streams the Louet, the Larcis, the Lees, and the Gros Lees (which two unite their streams), the Gabas, the Louts, the Luy de France, and the Luy de Béarn (which two also unite), flow through the north-eastern part of the department into one or the other of the adjacent departments of Hautes Pyrénées, Gers, or Landes, and afterwards unite with the Adour. The Gave de Pau, which rises in the department of Hautes Pyrénées, and the Gave d'Oleron (which is formed by the junction of the Gave d'Ossau or Osson, and the Gave d'Aspe), flow through the centre of the department from south-east to north-west, uniting their waters in the adjacent department of Landes and falling into the Adour. The Gave de Pau receives the Baise and the Luzon on its left bank; the Gave d'Oleron receives the Salies on the right, and the Vert and the Seison or Soisson on the left bank. The Bidouze, the Joyeuse, and the Nive flow into the Adour, having the whole of their course in the department or upon its border: the Bidouze receives the Hihouri on its left bank, and the Nive receives the Airi and the Hourepeleco, also on its left bank. The Nivelle and the Bidassoa fall into the Bay of Biscay, but the latter only touches the border of the department (which it separates from Spain), and that but for a short distance.

The navigable rivers of the department are thus given in the 'Statisque de la France:'—Adour, 15 miles; Bidouze, 12 miles; Laran, 9 miles; Ardanabia, 6 miles; Nive, 12 miles; Nivelle, 6 miles; Bidassoa, 4 miles—total, 64 miles.

Two of the rivers mentioned in this return, the Laran and the Ardanabia, are not laid down in the maps, nor mentioned in the other authorities which we have consulted; unless, which is very likely, they are designated by some other name. There are no navigable canals in the department. There are some small lakes in the Pyrenees, in the south-eastern corner of the department, and some marshes in the neighbourhood of Pau and Lescar.

There are six *routes royales*, or government roads, having an aggregate length of 261 miles; of which (on January 1, 1837) 227 miles were in good repair, 15 miles out of repair, and 19 unfinished. The principal road is that from Paris to Madrid, which crosses the Adour and enters the department at Bayonne, and runs through St. Jean-de-Luz to the bank of the Bidassoa opposite Irun, where it enters Spain. Roads run from Bayonne—one through the Port de Maya into Spain, and one by the valley of the Adour and the Gave de Pau to Orthès and Pau. The road from Paris to Pau branches off from the road from Paris to Bayonne at Roquefort, in the department of Landes, and enters the department near Garlin. The road from Paris to Orthès, St. Jean Pied-de-Port, and thence by the Port de Roncevaux, or Roncesvalles, into Spain, branches off from the road from Paris to Madrid, at Mont de Marsan, in the department of Landes, and enters this department at Sault de Nouailles. Roads run from Pau, one to Tarbes (in the department of Hautes Pyrénées), and one to Oléron, and from thence by the Port de Canfiane to Jaca in Spain. The departmental roads have an aggregate length of 417 miles, of which (January 1, 1837) 263 were in good repair, 59 out of repair, and 95 unfinished. The aggregate length of the bye-roads and paths is above 6000 miles.

The climate is healthy and mild, and the soil in the lower grounds is tolerably productive. There is however much waste land. The area of the department may be estimated in round numbers at 2,000,000 of acres, of which nearly 400,000 acres (or about one-fifth) are under the plough. The principal grain crops are wheat, rye, barley, oats, millet, and maize: the produce in wheat is by no means equal to the consumption of the department; maize is much used as an article of food. Very fine flax is also grown. There are about 160,000 acres of grass-land, besides nearly 500,000 acres of heath or other open pasture-ground, a large portion of it on the slopes and in the valleys of the Pyrenees. The quantity of cattle is very great; also of pigs, from which the Bayonne hams are made. The breed of horses is considered good; and mules are bred for the Spanish market. The vineyards occupy nearly 60,000 acres; the red wines of Jurançon and Gan are in the highest repute of any grown in the department; the brandy of Hendaye, on the Bidassoa, is also esteemed. There are above 320,000 acres of woodland: the forests are in a great degree composed of the fir, the pine, and the oak that produces the gall-nut: they supply excellent timber for house and ship building, and for the masts of vessels. About 16,000 acres are laid out in orchards and gardens. The mulberry is cultivated for the rearing of silkworms: the walnuts are excellent.

The department is divided into five arrondissements, as follows:—

Name.	Situation.	Area. sq. miles.	Communes.	Population in 1831.	1836.
Pau	N.E.	601	204	117,865	122,404
Oléron	S.E.	712	81	74,552	76,312
Orthès	N.	454	152	84,689	87,459
Bayonne	W.	411	53	78,411	84,519
Mauléon	S.	723	140	72,884	75,704
		2901	630	428,401	446,398

There are forty cantons or districts, each under the jurisdiction of a justice of the peace.

In the arrondissement of Pau are—Pau (pop. in 1831, 10,597 town, 11,285 whole commune; in 1836, 12,607 for commune) [Pau], Nay or Nai (pop. 3127 town, 3290 whole commune), and Lescar, all on the Gave de Pau; Gan (pop. 3027), on the Nées, a small stream which joins the Gave de Pau on the left bank below Pau; Morlaas, between the Luy de France and the Luy de Béarn; Garlin, near the Gros Lees; and Lembeye and Concher, near the Lees. Nay is on the left bank of the Gave, and is a tolerably well built town; the inhabitants manufacture druggets, hosiery, blankets, and other woollens; and carry on trade in linens and in Béarnais handkerchiefs: there are two fairs in the year. Abbadie, a Protestant divine of some note, was born at Nay. The castle of Goaraze or Gouraze, where Henri IV. was brought up, is in the neighbourhood of this town. Lescar is on a hill; it was built in the tenth century, by Guillaume Sanche, duke of Gascogne, and suffered much in the civil wars of the sixteenth century. It was the seat of a bishopric previous to the Revolution, and had a college under the direction of the Barnabites. The present population may be estimated at about 2000. Gan is in the midst of vineyards, which produce good red wine and some white wine. There are some mineral springs near the town, of which no use is made. Morlaas was antiently the capital of Béarn, and had a mint. The townsmen, who amount to more than 1500, carry on some trade in wine.

In the arrondissement of Oléron are—Oléron (pop. in 1831, 5850 town, 6458 whole commune; in 1836, 6620 commune), and Sainte Marie (pop. in 1831, 2718 town, 3371 whole commune), adjacent to each other at the junction of the Gave d'Aspe and the Gave d'Ossau, whose united streams form the Gave d'Oléron [Oleron]; Laruns and Arudy (pop. 1554 town, 1863 whole commune), on the Gave d'Ossau or Osson; Monein (pop. 5028 whole commune), on the Luzon; and Luc, between the Luzon and the Gave d'Oléron. Laruns is frequented by the persons who resort to the waters of Les Eaux Chaudes and Les Eaux Bonnes, which are in the neighbourhood. The waters of Les Eaux Bonnes are furnished by three sources; they acquired great reputation in the sixteenth century from their efficacy in curing some Béarnais soldiers wounded in the battle of Pavia, who called them 'Les Eaux des Arquebusades.' They have since been in repute for their efficacy in pulmonary complaints, and are among the most frequented mineral springs of the Pyrenees. The springs of Les Eaux Chaudes are five in number: they are recommended in asthmatic complaints, paralysis, and rheumatism. Some trade in wine is carried on at Monein. Luc is a well built place in a pleasant situation, with a population of from 2000 to 3000.

In the arrondissement of Orthès are—Orthès (pop. in 1831, 5195 town, 7121 whole commune; in 1836, 7857 commune) [Orthes], and Lagor, on or near the Gave de Pau; Navarreins, Sauveterre, and Salies (pop. 4730 town, 8420 whole commune), on or near the Gave d'Oléron; La Bastide de Béarn, near the Seison; Morlane, on the Luy de Béarn; Arthès, between the Gave de Pau and the Luy de Béarn: and Arzacq, near the Louts. Navarreins is a fortress of little strength; it was founded by Henri of Albret (ma-ternal grandfather to Henri IV.) in 1569, and resisted an attack of the Catholic army in the religious wars of that century. It is built with tolerable regularity, with broad and straight streets, and is in a fertile plain on the right bank of the Gave d'Oléron, over which there is a stone bridge at the junction of two brooks. There are barracks and a prison. Some weaving is carried on by the townsmen, who scarcely amount to 1500. Salies owes its prosperity to two brine-springs, from which a very white salt is made, and to the hams cured in and about the town, which are exported under the name of Bayonne hams.

In the arrondissement of Bayonne are—Bayonne (pop. in 1831, 13,008 town, 14,773 whole commune; in 1836, 15,912), on the left bank of the Adour, a short distance above its mouth [BAYONNE]: Bidache and Guiche, on the Bidouze; La Bastide de Clairence [BASTIDE, LA] and Hasparren (pop. 5357), on or near the Joyeuse: Espelette, on a brook flowing into the Nive; and St. Jean-de-Luz (pop. 2056 town, 2860 whole commune), on the sea at the mouth of the Nivelle. Bidache has a population of from 2000 to 2500: freestone is quarried in the neighbourhood. Hasparren is a busy place, with many tan-yards and currying-shops, the leather made in which is exported to Spain. There is also a considerable trade carried on in cattle both at Hasparren and at Espelette. St. Jean-de-Luz is united by a bridge over the Nivelle, more remarkable for length than for beauty, with the little town or village of Sibourre, the population of which is about 1500 or 2000. St. Jean-de-Luz was formerly a place of considerable trade: in the time of Louis XIV., who was married here to Maria Theresa, Infanta of Spain, it is said to have contained a population of 14,000. It was one of the ports which carried on commerce with the French colonies in America. At present it is much decayed. The harbour is formed by the mouth of the Nivelle, which is tolerably wide, and up which the tide flows. The banks of the river are lined with quays, and the entrance is protected by a pier or breakwater. The inhabitants are chiefly seamen, engaged in the cod or pilchard fishery, or in carrying on some trade with Spain: they are said to speak the Basque tongue with greater purity than any of their neighbours. There is a free-school for teaching navigation. In the neighbourhood of the town some severe fighting took place between the French and Spaniards in 1793, and between the French and the allies under Lord Wellington in 1813-14. At the village of Cambo, on the Nive, are some mineral waters. The bath-rooms, which are of modern erection, are of simple and elegant architecture.

In the arrondissement of Mauléon are—Mauléon (pop. in 1836, 1259 commune) and Licharre, on or near the Seison (which is sometimes called the Gave de Mauléon); Ostabat, St. Palais, and Garris, on or near the Bidouze; and St. Jean-Pied-de-Port, on the Nive. Mauléon was antiently the capital of the valley or district of Soule, and is said [illegible] have been the first settlement of the Vascons, or Gascons, [illegible] the north side of the Pyrenees. The town is old and ill [illegible]t, but in an agreeable situation: the population scarcely [illegible] 200. There are two yearly fairs. There are in the town a subordinate court of justice and a high school. St. Palais, a town of 1000 or 1200 inhabitants, is surrounded by an antient wall: it is situated in a fertile corn-district. It was formerly of more importance, and had a mint: it has now a subordinate court of justice. St. Jean-Pied-de-Port is situated, as its name implies, at the foot of one of the ports, or passes, of the Pyrenees: its situation renders it one of the keys of France on this side: its citadel, placed on an eminence, commands the entrance of three gorges, by which there is communication with Spain. The town is small, and has narrow streets, with a church and a prison. The inhabitants, who are about 2000 or 2500 in number, make [illegible]her, and carry on trade in wool: there are two cattle-[illegible]s. This town was founded in the eighth century, and [illegible] the capital of Basse (Lower) Navarre: it was finally [illegible] to France by the treaty of the Pyrenees. The villag[illegible] of St. Etienne de Baigorry (pop. 1599 village, 3463 whole commune), was formerly the seat of mining operations of considerable importance: it is in the valley of Baigorry. [BAIGORRY.]

The population, when exactly given, is, unless otherwise described, that of the whole commune, and from the census of 1831.

The department constitutes the diocese of Bayonne, the bishop of which is a suffragan of the archbishop of Auch: it is in the jurisdiction of the Cour Royale and the circuit of the Académie Universitaire of Pau: it is included in the eleventh military division, the head-quarters of which are at Bordeaux: and it sends five members to the Chamber of Deputies. In respect of education, it is above the average of France. Of the young men enrolled in the military census of 1828-29, forty-seven in every one hundred could read and write, the average of France being thirty-nine in every one hundred.

This department was antiently included in the territories of the Tarbelli, who occupied the coast; of the Sibyllates, who are considered to have occupied the valley or district of Soule; of the Osquidates Montani, who probably occupied the valley of Ossau; of the Monesi, whose name may be traced in the town of Monein; and of some other Aquitanian nations, the names of which are not known. In the Roman division of Gaul, it was included in the province of Novempopulana, a subdivision of Aquitania. There were several Roman towns or posts within its limits. Lapurdum, mentioned in the 'Notitia' as a military post, and which has left a trace of its name in the province of Labour, was at or near Bayonne. Carasa and Imus Pyrenaeus (the foot of the Pyrenees), mentioned in the 'Antonine Itinerary,' in the route between Aquae Tarbellicae (Dax) and Pompelo (Pampeluna), were probably at or near Garris and St. Jean-Pied-de-Port respectively: while the Summus Pyrenaeus, which the Itinerary places in the same route, nearer Pompelo, corresponds to the Port de Roncevaux, or Roncesvalles. The Iluro of Antoninus may be easily recognised in Oléron: Aspaluca was probably at the village of Acous, in the valley of Aspe; and Forum Ligneum (the wood-mart) was probably at Urdos, higher up the same valley. These two places are mentioned in the route between Iluro and Caesaraugusta (Saragossa) in Spain; the Summus Pyrenaeus of this route was probably the Port de Bernère, between the valleys of Aspe and Aragues. The Beneharnum of Antoninus, which gave name to the province of Béarn, appears to have been between Orthès and Lescar, and the Oppidum Novum of the same writer at Nay.

In the centuries which immediately succeeded the downfal of the Roman empire, the Visigoths, the Franks, the Gascons, and the Saracens at different times occupied this country. It was subsequently included in the empire of Charlemagne; and in the middle ages a large part of it was comprehended in the viscounty of Béarn, which was possessed by the kings of Navarre, and united to the French crown on the accession of Henri IV. [BEARN.] The parts not included in Béarn were:—the Pays de Labour, capital Bayonne; Basse (or Lower) Navarre, capital St. Jean-Pied-de-Port; and the Pays de Soule, or Vallée de Soule, capital Mauléon, all comprehended under the general title of Pays des Basques [BASQUES, PAYS DES], and all included in the military government of Guyenne and Gascogne. [GUYENNE.] Béarn, though properly a part of Gascogne, formed a separate military government.

PYRE'NE'ES, HAUTES, a department in the south of France, bounded on the north by the department of Gers, on the east by that of Haute Garonne, on the south by Spain (from which it is separated by the crests of the Pyrenees), and on the west by the department of Basses Pyrénées. The form of the department approaches to that of a quadrangle, the diagonals of which are its longest dimensions. It length from north-west to south-east, from the neighbourhood of Castelnau de Rivière Basse to the source of the little river Pique at the Port de Picade, at the head of the valley of Luchon, is 75 miles; and from north-east to south-west, from the banks of the Gimone opposite Boulogne, to the source of the Gave d'Azun, 57 miles. The area is estimated at 1825 square miles, being much below the average area of the French departments, and rather less than that of the English county of Northumberland. The population, in 1831, was 233,031; in 1836 it was 244,170: showing an increase in five years, of 11,139, or nearly five per cent., and giving nearly 134 inhabitants to a square mile. In amount of population it is very far below the average of the French departments; in density of population also it is considerably below the average, but exceeds, both in amount and density, the English county with which we have compared it. Tarbes, the capital, is 400 miles in a direct line south by west of Paris, or 533 miles by the road through Orléans, Châteauroux, Limoges, Cahors, Montauban, Toulouse, and Auch; in 43° 14′ N. lat. 0° 4′ E. long. [TARBES.]

The surface of the department is very mountainous; the principal ridge of the Pyrenees forms the southern boundary, and the branches from that ridge traverse the department in a northward direction, leaving scarcely any portion of it which can be considered as a plain. The principal of these lateral branches is that which separates the basin of the Garonne from that of the Adour, and which extends through this department into the adjacent department of Gers. That part of the principal ridge which is upon or within the boundary of the department includes some of the loftiest summits of the whole range. Mont Maudit, or Maladetta, and Mont Perdu, lie indeed without the boundary, the first some distance to the south-east, and the second a little to the south; both belong to Spain; but the summits Batoa or Biedous, Arré (Upper and Lower), Baroudes, Pic de la Cascade, Les Tours de Marboré, Le Pimené, Le Taillon, Troumouse, Aiguillon, Campbiel, Pic Long Neouvielle, Arbizon, Pic-du-Midi de Bigorre, Viguemale, or Vignemale, Badescure, Arrieu Grand, all of them exceeding 9000, some exceeding 10,000, and one or two rising to more than 11,000 feet, belong to this department; besides a number of other peaks of considerable height. The ports or passes of Clarabide, Lapez, Plan, Viel or Vieux, Pinède or Estaubé, Gavarnie or Boucharo, Campbiel; the Brèche de Roland, and the Brèche de Tuque Rouye; the Col de Pimené (otherwise Brèche d'Allans), and the Cols of Tourmalet, Lavasse, or l'Avase, and Loubie, also belong to this department. [PYRENEES.] None of the passes are much frequented; perhaps the most so is that of Gavarnie or Boucharo, through which passes the road from Tarbes to Ainsa and Jaca in Spain. Through the Port de Penticouse runs another road from Tarbes by the valley of Cauterez to Jaca, and through the Port de Bielsa, a road from Auch by Arreau to Ainsa in Spain. The glaciers of the Brèche de. Roland, Vignemale, and Neouvielle belong to this department.

The principal valleys of the department of Hautes Pyrenees are the valley of Barillos, the valley of Louron, the valley of Aure, into which open the valleys of Rioumajou and Couplan, the valley of Campan, into which opens the valley of Oussouet; and the great valley of Lavedan or Baréges, the upper part of which is sometimes called the valley of Gavarnie or of Gédre, and into which open the valleys of Ossonne, Estaubé, Héas, Poeyasbé, Campbiel, Pragnères, Bastan, Cauterez, Bun, Azun, Estreme de Sales, and Castel-Loubon. We have enumerated the principal valleys in the order in which they occur from east to west; the subordinate valleys, in the order in which they open into the principal ones, commencing at the head of the principal valley on the Spanish frontier. The valleys of Barillos and Campan are a considerable distance northward from the main ridge.

Some of the loftiest mountains of the Pyrenees, as those east of the Port de Clarabide, Vignemale, and Neouvielle, with their respective surrounding peaks, are composed of granitic rocks, which rocks are also found in the upper part of the valley of Lavedan, between Gédre and Gavarnie, in the valley of Héas, in the upper part of the valley of Aure, near the village of Plan, and in detached portions in one or two other places. The Pic-du-Midi of Bigorre, and the surrounding district, extending eastward to Arreau in the valley of the Neste, and westward to Cauteres, or Cauterez, in the valley of Cauterez, are occupied by mica-slate. The greater part of the Pyrenees are however composed of transition rocks, namely, clay-slate and grauwacke, in the neighbourhood of the primitive formations, and limestone toward the foot of the chain and the plains at its base. The red-sandstone, or red-marl formation, is found in one or two places, chiefly on the east side of the department. A district extending eastward from the neighbourhood of Bagnères de Bigorre, into the department of Haute Garonne, and having no great extent from north to south, is occupied by the Alpine limestone; and small detached masses of secondary trap rocks are found both in the transition and Alpine limestone districts. The rest of the department, north of a line drawn from west to east, from near St. Pé, passing between Tarbes and Bagnères de Bigorre to Barthe de Neste, is occupied by the tertiary formations.

The mineral produce of the department is not great. Some beautiful varieties of marble are quarried in the valley of Campan. There were in the department, in 1834, two establishments containing three forges for making wrought-iron. Charcoal was the fuel employed.

The department belongs partly to the basin of the Adour, and partly to that of the Garonne.* The Adour rises at the upper end of the valley of Campan, through which it flows in a northward direction, passing Campan and Bagnères de Bigorre: it afterwards passes Tarbes and Maubourguet, a few miles below which it quits this department to enter that of Gers. The Lechez, which receives the Soui, and the Louet, join the Adour on the left bank; the Estreax and the Arros, which last receives the Boues, join it on the right. The Arros and Boues belong partly to the department of Gers; the Louet partly to that of Basses Pyrénées. The upper part of the course of the Gave de Pau [PYRENEES, BASSES] belongs to this department: it waters the valley of Lavedan: the Gave d'Azun and the Gave de Bun, which water the valleys of Azun and Bun, and the Gaub and the Lantour, which water the valley of Cauterez, flow directly or ultimately into the Gave de Pau. The principal feeders of the Garonne which belong to this department are the Baise, the Gers, and the Neste. The two former rise in the eastern part of the department, and flow northward into the department of Gers, the Gers being the more easterly of the two. The Baisole and the Baise-devant, which run parallel to the Baise, and ultimately unite with it, have their springs and their courses between the Baise and the Gers. The Baise, before the junction of the Baise-devant, is sometimes distinguished as the Baise-derrière. The Neste rises in the south-eastern corner of the department and flows northward to La Barthe de Neste, where it turns eastward and flows into the department of Haute Garonne: at Arreau it receives on its left bank the little river Seeaux. The Neste above Arreau is sometimes distinguished as the Neste de Louron, and the Seeaux as the Neste d'Aure. They water respectively the valleys of Louron and Aure. The Lourse is a small feeder of the Garonne, into which it flows a short distance above the Neste. The Garonne itself has a small part of its course on the eastern border of the department, near the town of St. Bertrand in the department of Haute Garonne.

There are no navigable streams or navigable canals in the department. The Garonne is used in this part of its course for floating the fir timber cut in the mountains near it. There are numerous lakes in the Pyrenees, but none of them large. The lake of the Port d'Oo, in the south-eastern corner of the department, is perpetually covered with ice: the lakes of Estom Soubiran, in the valley of Cauterez, are covered with ice till the end of August. The Lac de Gaube, at the head of the valley of Cauterez, abounds with trout. Waterfalls are frequent in the mountains: the most remarkable is the fall of the Gave de Pau at Gavarnie, near its source. It is in an amphitheatre at the head of the valley of Gavarnie, surrounded with walls of rock, which rise to the height of above 1500 feet perpendicular. A circle of torrents shoot from these stupendous heights: some, dashing upon the projecting precipices, are split into slender jets, which a passing gust of wind converts into a shower; others, of greater volume and force, shoot from the platform and descend unbroken. The fall of the Adour is the most magnificent of these, and surpasses every other cataract in Europe in height.

There are five government roads (routes royales) in this department; their aggregate length is 179 miles, of which (on the 1st of January, 1837) 154 miles were in good repair, 17 out of repair, and 8 unfinished. The principal road is that from Paris by Auch to Tarbes; continued onward from Tarbes by Lourdes, Argellez, and Lus to Barèges, and by Lus and the valley and port of Gavarnie into Spain. Another road from Tarbes to Barèges passes through Bagnères de Bigorre and Campan; and there are roads from Tarbes to Pau (Basses Pyrénées); from Tarbes by Vic Bigorre and Maubourguet to Aire (Landes) and thence to Bordeaux (Gironde); and from Tarbes by Tournay and Lannemezan to St. Gaudens (Haute Garonne) and other towns on the banks of the Garonne. A road from Auch passes along the valleys of the Gers and the Neste to Sarrancolin, Arreau, and Anzizan, and over the Port de Bielsa to Ainsa in Spain. The departmental roads have an aggregate length of 118 miles, of which (1st of January, 1837) 78 miles were in good repair, 32 miles out of repair, and 8 miles unfinished. The bye-roads and paths have an aggregate length of nearly 3000 miles.

The climate of the department varies with its elevation: from the lofty southern border to the lower grounds of the northern border the vegetation changes from that of the frigid to that of the temperate zone. The surface is estimated in round numbers at above 1,100,000 acres. Of this rather more than 230,000 acres are under the plough: the produce in grain is insufficient for the consumption of the department. Some flax is also grown. The meadows occupy about 110,000 acres, and the heaths and open pasture-grounds, chiefly on the slopes of the Pyrenees, amount to about 430,000 acres; the lower slopes furnish the winter pasturage and the upper valleys the summer pasturage for the numerous flocks and herds belonging to the active and intelligent peasantry who inhabit the mountains. When the uplands are cleared from snow, the peasant drives his flock or herd up to them; he finds his summer abode in some cleft, or in a cabin previously erected, or, in want of this, builds himself a hut of rude stones. On the approach of winter he drives his cattle to the lower ground, and occupies the hut which has served as a summer habitation to his family, who now descend into the village. Round this hut the fodder which is to assist in sustaining his cattle in the winter is grown; and the skill shown by the peasantry in irrigating their meadows is considerable. The oxen are commonly poor, but some good butter is made. Horses are little used in agriculture, but very much for carrying produce: they are an ill-looking though active race. Mules are bred in considerable number for exportation to Spain, and several of them are fine animal

The vineyards occupy nearly 40,000 acres: the best red wines are grown in or near the valley of the Louet, about Castelnau-de-Rivière-basse and Madiran. A considerable part of the wine produced in the department is converted into brandy. There are about 6000 or 6500 acres of orchard or garden ground; and the osier beds cover more than 4000 acres. The woods comprehend an area of 200,000 or 210,000 acres.

The department is divided into three arrondissements, as follows:—

Name.	Situation.	Area in sq. miles.	No. of Communes.	Population in 1831.	Population in 1836.
Tarbes .	N. .	565	197	104,022	110,542
Argelès .	S.W. .	518	100	39,785	40,582
Bagnères	E. .	730	195	89,224	93,046
		1753	492	233,031	244,170

There are twenty-six cantons, or districts, each under a justice of the peace.

In the arrondissement of Tarbes are—Tarbes (pop. in 1831, 9706; in 1836, 12,630) [TARBES], and Maubourguet (pop. 1506 town, 1725 whole commune), on the Adour; Vic-Bigorre (pop. 3599 town, 3679 whole commune), on the Lechez; Ossun (pop. 3243) and Ibos, on the Soui; Castelnau-de-Rivière-basse and Madiran, on or near the Louet; Rabastens, on the Estreux; Tournay and St. Sever, on the Arros; Trie, on the Baise-derrière; and Gallan, on the Baise devant. Maubourguet has a parish church of great antiquity, built by the Templars; it is of singular architecture, the style being of a mixture of Gothic and Oriental. Vic-Bigorre has brandy-distilleries and tan-yards. The people of Ossun are distinguished from their neighbours by the singularity of their dress, language, and manners; they trade in hams. Castelnau-de-Rivière-basse is on a tolerably extensive eminence commanding the surrounding plain. It has a pretty good 'place,' or square, at one corner of which is the parish church. It has also a market-house. Rabastens was antiently fortified; it was taken and burned by the Roman Catholics under Montluc in the religious wars of the sixteenth century, and the townsmen massacred. The population is about 1500. There are several fairs in the year. Tournay is tolerably well built, with a very large 'place,' or square; but it is a very small town. It has several fairs. St. Sever, distinguished as St. Sever-de-Rustan, has the remains of the large and fine Benedictine Abbey of St. Sever, to which the town owes its name. Trie is tolerably built, and has a large square surrounded with a wooden arcade or piazza. The church is remarkable for its solid architecture and the loftiness of its spire; and there is a bridge over the Baise-derrière, of one arch, very lofty in order to give free passage to the floods to which that river is subject. Gallan, or Galan, is agreeably situated, and has a very antient parish church. It has four yearly fairs for cattle, mules, and corn.

In the arrondissement of Argelès are—Argellès, or Argellez (pop. in 1836, 1420 for the commune), Lourdes (pop. 3161 town, 3818 whole commune), St. Pé (pop. 1983 town, 2754 whole commune), and Lus, or Luz (pop. 1934 town, 2357 whole commune), on the Gave de Pau; Cauterez, on a feeder of the same river, in the valley of Cauterez; and Barèges, on another feeder not far from Lus. Argelès is situated in a delightful valley, abounding in fruits of every description; it has a high school, and a church of very massive architecture. Lourdes is built at the foot and on the side of a hill, the summit of which is occupied by the remains of an antient castle, now used for a prison. The fortifications of the castle were improved by Edward the Black Prince when duke of Aquitaine; and it was long and gallantly defended by the partisans of the English, until the entire expulsion of the latter from this part of France. Lourdes has an hospital; and the court of justice for the arrondissement has its seat here. There are several tan-yards; linens are manufactured, and there are four yearly fairs for corn, horses, and mules. Marble and slate are quarried in the neighbourhood. There are some remains of Roman architecture at Lourdes. St. Pé is surrounded by mountains and forests. It is a curious old town. The inhabitants manufacture linens, handkerchiefs, combs, nails, and tools. Lus, or Luz, has narrow streets and old houses. The church, built by the Templars, appears to have been designed for the purpose of defence it is surrounded by a high wall provided with embrasures. The townsmen manufacture a fabric of silk and wool mingled. About half a mile from Luz, in a picturesque situation, are the baths of St. Sauveur, resorted to by a considerable number of visitors. In the neighbourhood are the ruins of the castle of St. Marie.. Cauterez is built in a valley in the neighbourhood of some of the highest mountains and some of the finest scenery of the Pyrenees. It is a fashionable watering-place. The baths are higher up the valley, at some distance from the town: they are adorned with Grecian porticos, esplanades, and terraces. Those persons who cannot walk from the town to the baths are carried in a kind of chair or palanquin by porters. Barrège has been described elsewhere. [BARREGE.]

In the arrondissement of Bagnères are—Bagnères de Bigorre (population in 1831, 5633 town, 7586 whole commune; in 1836, 8108 commune) [BAGNERES DE BIGORRE], and Campan (population 3015 town, 4171 whole commune) [CAMPAN], on the Adour; Ansizan, Arreau, and Sarrancolin, on the Neste; Lannemezan, on the Baise-devant; and Monléon and Castelnau de Magnoac, on or near the Gers. Arreau is a very old town; the inhabitants (who are about 1300 to 1500) manufacture the coarse woollens worn by the surrounding peasantry, and woollen hose. Sarrancolin, another old town, has a church built by the Templars. Paper is made in the town, and marble is quarried in the neighbourhood. Lannemezan is a dull place; it has however several considerable cattle-fairs. Monléon is pleasantly situated. At Castelnau de Magnoac considerable trade is carried on; wax is bleached, and wax candles and woollen stuffs manufactured.

The population given above, when given exactly, is (unless otherwise described) that of the commune, and from the census of 1831. When given approximately, it is from returns of an older date.

The department constitutes the diocese of Tarbes, the bishop of which is a suffragan of the archbishop of Auch. It is included in the jurisdiction of the Cour Royale of Pau, and in the circuit of the Académie Universitaire of the same city: it is in the tenth military division, the head-quarters of which are at Toulouse; and it sends three members to the Chamber of Deputies. In respect of education, it is considerably above the average of the French departments. Of the young men who were enrolled in the military census of 1828-29, 53 in every hundred could read and write; the average of France being 39 in every hundred.

This department was antiently comprehended in the territories of the Bigerrones, the Convenæ, the Ausci, the Camponi, the Onobusates, the Tornates, and other Aquitanian nations. The Bigerrones occupied the western, the Convenæ the eastern, and the Ausci the northern part. The Camponi probably occupied the valley of Campan; the Onobusates probably the district of Nébouzan in this department and in that of Haute Garonne. On the subjugation of Gaul, these nations were included in the Roman province of Aquitania, and on its subdivision, in that of Novempopulana. There were several Roman towns or posts within the limits of the department. Turba, now Tarbes, is mentioned in the 'Notitia,' with the description 'ubi Castrum Bigorra.' Gregory of Tours calls it Civitas Bigorra, and it was the capital of the Bigerri or Bigerrones, who have left their name to the province of Bigorre. A place called Aquæ or Aquensis Vicus is shown, by some Roman inscriptions found there, to have been at Bagnères de Bigorre. Tournay, to judge by its name, was probably the capital of the little tribe or nation of the Tornates. Aquæ Convenarum, mentioned by Antoninus, was probably Cap-bern or Capvern, near Lannemezan, where there are still some tolerably frequented mineral springs. Belsinum, also mentioned by Antoninus, may probably be fixed in the neighbourhood of Castelnau de Magnoac, close upon if not within the boundary of the department.

At a subsequent period, these territories were contested by the Visigoths, Franks, Saracens, and Gascons. In the middle ages, the western side, except just the north-western extremity, constituted the county of Bigorre [BIGORRE], subdivided into 'La Plaine,' the district north and west of Tarbes; Le Rustan, about St. Sever; and Les Montagnes, including the valleys of Lavedan, Campan, Barrège, and Azun. The rest of the department, except the valleys of Louron and Oeil in the south-eastern corner, which belonged to the district of Comminges [COMMINGES], was included in Armagnac [ARMAGNAC]. Of this part the north-western extremity, about Castelnau de Rivière-basse, constituted the district of Rivière-basse, in Basse or Noir (Lower or Black) Armagnac: the remainder was divided between the county of Astarac, Les Quatre Vallées or the Four Valleys (of Magnoac, Neste, Aure, and Barousse), and Le Nebouzan, all in Haut or Blanc (Upper or White) Armagnac. These districts were comprehended in the province of Gascogne. [GUYENNE AND GASCOGNE.] Bigorre was included in the duchy of Aquitaine or Guienne, as established by the treaty of Bretigny (A.D. 1360), and its strongholds were held by the English for several years. It afterwards came to the kings of Navarre, and, on the accession of Henri IV., was united to the crown of France.

PYRE'NE'ES ORIENTALES, a department of France, situated, as its name implies, at the eastern extremity of the Pyrenees. It is bounded on the north by the department of Aude, on the north-west by that of Arriège, on the west and south by the province of Catalonia in Spain (from which it is for the most part separated by the Pyrenees), and on the east by the Mediterranean. Its form approximates to that of a wedge or triangle, having its sides respectively facing the north-north-west and the south; the shore of the Mediterranean representing the back or base, and the upper extremity of the valley of Carrol the point: the side toward the north-north-west is about seventy miles long, the side towards the south seventy-five miles; the length of the back or base is little more than twenty-nine miles. The area is estimated at 1594 square miles, about two-thirds of the average area of the French departments; rather greater than the area of the English county of Kent, but rather less than that of Hampshire. The population, in 1831, was 157,052; in 1836, it as 164,325, showing an increase in five years of 7273, or more than 4·5 per cent.; and giving 103 inhabitants to a square mile. Both in amount and density of population it is far below the average of France; in amount little more than two-fifths, and in density less than two-thirds of the average. Its population is about half that of Hampshire, and one-third that of Kent. Perpignan, the capital, is 425 miles in a straight line south of Paris, or 569 miles by the road through Orléans, Limoges, Cahors, Montauban, Toulouse, Carcassonne, and Narbonne; in 42° 42′ N. lat. and 2° 54′ E. long.

The coast runs from the northern boundary to the neighbourhood of Collioure, about twenty-one or twenty two miles due south, in an almost direct line: it is throughout all this extent skirted by a low alluvial tract overspread with marshes, whose exhalations would be seriously injurious to health if it were not for the corrective influence of the keen north-west wind, called, from its blowing across the Corbières, a branch of the Pyrenees, the 'Tramontane.' In the northern part of this line of coast, partly in this department and partly in that of Aude, is the étang (pool or lagoon) of Leucate, and south of this are the smaller lagoons of St. Nazaire and St. Cyprien, all belonging to that line of étangs which characterises the French part of the Mediterranean coast. From the neighbourhood of Collioure the coast turns to the south-east, and its loftier character and more broken outline indicate its vicinity to the Pyrenees. The French portion of it terminates at Cape Serbères or Cervère, about eight or nine miles from Collioure.

The greater part of the department is of very mountainous character. The Pyrenees commence on the east coast and run westward, their principal ridge forming the frontier of the department toward Spain, and throwing off two subordinate lateral ranges in a north-east direction; one of which, not distinguished by any particular name, but remarkable for one of its mountains, Le Canigou, separates the valley of the Tech from that of the Tet or Teta: the other, the Corbières, separates the valley of the Teta from that of the Aude. From the Col de la Couillade, south of the fortress and town of Montlouis, the principal ridge lies within the boundary of the department, which includes the valley of Carrol or Carol and the other valleys drained by the upper waters of the Sègre on the southern slope. A branch of the Pyrenees forms the western boundary of the valley of Carrol. The peaks of Le Canigou in the branch range which separates the valleys of the Tech and the Tet; Peyric or Prigue, at the head of the valley of the Teta; Lanoux, at the head of the valleys of the Arriège and of Carrol; and Pedrous, near Lanoux, all exceed 9000 feet in height, and the last rises to about 9500 feet. [PYRENEES.] The mountain of Mosset, one of the Corbières, has an elevation of 7828 feet; and Roc Blanc, at the separation of the Pyrenees and the Corbières, at the head of the valley of the Aude, of 8246 feet. The principal valleys are those of the Tech, between the branch to which Mount Canigou belongs and the main ridge of the Pyrenees; of the Tet, between this same branch and the Corbières; of the Gly, between the branches of the Corbières; and the valley of Carol (the stream from which joins the Sègre at Puycerda in Catalonia), and the other valleys drained by the upper waters of the Sègre. The principal depressions or passes are the Col de Pertus, through which runs the main road from Perpignan to Figueras in Spain: the Col de la Perche, through which passes the road from Montlouis to Puycerda and Urgel in Catalonia; the Col de la Marguerite, between the valley of the Teta and that of the Aude; and the Col de la Couillade, at the head of the valley of the Sègre. The bridge of Céret, a small town in the valley of the Tech, is 317 feet above the level of the sea; the town of Arles 899 feet, the village of Montfleret 2540 feet (both these are in the same valley), and the town of Montlouis 5206 feet.

The Pyrenees are in this part composed almost entirely of granitic rocks, as also is that part of the Corbières which lies nearest to the Pyrenees. Not only the peaks, but the intervening valleys are in great part occupied by these formations. This is the case with all that part of the valley of the Aude which lies in this department, with the valley of the Teta or Tet nearly down to the town of Millas, except just about Villefranche, and with the valley of the Tech to the village of Le Fort between Arles and Céret, except in the vicinity of the fortress of Prats-de-Mollo and the village of Le Tech. The mountains which bound the valley of the Aude on the western side, and occupy the extremity of the department toward the west, are composed of mica-slate, which is not found anywhere else in this department. The transition rocks are found near the base of the granitic mountains, except where their continuity is interrupted by the tertiary or alluvial beds. In the valley of the Tech above Céret, and extending northward across the extremity of that small branch mountain-range to which Le Canigou belongs, these transition rocks consist of clay-slate and transition limestone. A mass of similar formations occupies the upper part of the valley of the Tech, in the vicinity of Prats-de-Mollo and Le Tech. About Villefranche, in the valley of the Tet, is found a mass of compact grey limestone, enclosing beds of grey marble veined with red and green, probably belonging to the transition series. The localities occupied by these two masses of transition rocks are isolated in the district of the granitic formations. The valley of the Gly from Estagel upwards, and that part of the Corbières which lies at the head of the valley, are formed of transition rocks, which skirt the granitic district on the north side, and extend northward and westward into the department of Aude: the predominant rock is compact grey limestone. The valley of Carol and the valleys watered by the tributaries of the Sègre are, in this department, occupied by the transition rocks. A small portion of the department to the north of Estagel is occupied by the Alpine and Jura limestone, which formations extend northward into the department of Aude, where they overspread a large district. All the eastern side of the department, comprehending the sea-coast, the plain which extends for some miles inland from the coast, and the valleys of the Gly, the Tet, and the Tech, to near Estagel, Millas, and Céret respectively, are occupied by tertiary or alluvial formations, chiefly consisting of vast beds of sand or gravel. The mineral treasures of the department are inconsiderable. There are twenty establishments, each comprehending a single forge, for the manufacture of wrought-iron. Charcoal is the only fuel employed.

The department has no large rivers: three small portions, all near the western end of the department, belong to the basins of the Garonne, the Ebro, and the Aude. These portions are drained respectively by the Arriège, the Sègre, and the Aude, all of which have their rise and a small part of their course in this department. The Aude receives two small mountain-streams, the Balcerre and the Galba; the Sègre receives the Carrol or Carol from the valley of Carol, the Err, and the Vanera. The Tech rises in the Pyrenees on or near the southern boundary of the department, and flows about 40 to 45 miles east-north-east past Prats-de-Mollo, Arles, Céret, and Elne, into the Mediterranean. The Tet or Teta rises in the Pyrenees near the junction of the Corbières, and flows about 12 miles south-east to Montlouis, and from thence east-north east about 50 to 55 miles, making its whole course 62 to 67 miles, past Olette, Villefranche, Prades, Vinçac, Ille, Millas, and Pepignan, into the Mediterranean. Between Ille and Pepignan, it is divided into two arms, enclosing between them a large island: the northern and principal arm retains the name of Tet; the southern, which passes by Thuir, is called the 'Canals.' The Tet receives below Montlouis the Carensa, the Lantilla, and the Boules on the right bank; the Cabrils and the Castellanne on the left. The Gly rises in the department of Aude, and flows about 40 miles, first south-east and then east, past St. Paul-de-Fenouillet, La Tour-de-France, Estagel, and Rivesaltes, into the Mediterranean; receiving on the left bank the Verdouble and the Robouls. Its course is mostly in this department. The Cantarana has its course parallel to and between the Tech and the Tet, and flows into the étang of St. Nazaire: it receives the Reart. There are some small lakes in the mountains, and the étangs of St. Cyprien, St. Nazaire, and Leucate on the coast. None of the rivers are navigable, neither are there any navigable canals.

There are in the department seven Routes Royales or government roads, having an aggregate length of 202 miles, viz. 103 miles in repair, 9 miles out of repair, and 90 miles unfinished. (1 Jan., 1837.) The principal road is that from Paris to Perpignan, which enters the department on the north side, close to the western bank of the étang of Leucate, and runs south to Perpignan; from whence it continues through Le Boulou and the fortress of Bellegarde, by the Col de Pertus into Spain. From Perpignan a road runs south-east through Elne, Argelès, Collioure, and Port Vendres into Spain. Another road from Perpignan follows the valley of the Tet by Ille, Vinçac, Prades, Villefranche, Olette, Montlouis, and Livia, by the Col de la Perche, to Puycerda and Urgel in Spain. Another road from Perpignan runs north-west to the valley of the Gly, and passes through Estagel, St. Paul de Fenouillet, and Caudies to Quillan in the valley of the Aude, forming part of a road which crosses France on the northern side of the Pyrenees from Perpignan to Bayonne. From Le Boulou, on the main road into Spain, between Perpignan and Bellegarde, a road runs up the valley of the Tech by Céret and Arles to Prats de Mollo. A road from Carcassonne, Limoux, and Quillan, in the valley of the Aude, runs up the valley, and crosses the mountains at its head to Montlouis, in the valley of the Tet. The aggregate length of the Routes Departmentales is 81 miles, viz. 27½ miles in good repair, 8½ miles out of repair, and 45 miles unfinished. The bye roads and paths have an aggregate length of nearly 2000 miles.

The climate of the department is generally mild and temperate. The soil of the plain and of the valleys of the Tech and the Tet is remarkable for its fertility. Of the whole area of the department, which is estimated at about 1,000,000 acres in round numbers, about 230,000 acres, or less than one-fourth, are under the plough. The quantity of grassland is small, comprehending little more than 24,000 acres; but the heaths and open pasture-grounds are extensive, amounting to nearly half the area of the department. The number of cattle is small; but sheep, including Merinos, are numerous, and the Cashmere or Thibet goat has been naturalised. Mules are reared in considerable numbers; and the breed of horses, already in good repute, is improving. The slopes of the mountains and other uncultivated lands are covered with thyme, rosemary, lavender, and various odoriferous shrubs or herbs, which furnish nourishment to swarms of bees, whose honey and wax form an important article of produce. The vineyards occupy from 90,000 to 100,000 acres: the produce is considerable, and about two-fifths of it are exported. The wines of the first quality are those of Rivesaltes, Salces, and Collioure. Part of the wines are liqueur wines. Orchards are not numerous, occupying only about 3000 acres; but the quantity of fruit grown is very considerable; among the kinds cultivated are the olive, the orange, the citron, the mulberry, and the melon; oil is made and raw silk produced. The woodlands amount to about 110,000 acres.

The department is divided into three arrondissements, as follows:—

Name.	Situation.	Area in sq. miles.	No. of Communes.	Population in 1831.	1836.
Perpignan	N. and N.E.	531	85	72,814	76,134
Céret .	S. and S.E.	358	41	35,421	37,539
Prades .	W.	705	100	48,817	50,652
		1594	226	157,052	164,325

There are seventeen cantons, or districts, each under a justice of the peace.

In the arrondissement of Perpignan are—Perpignan (pop. in 1831, 16,272 town, 17,114 whole commune; in 1836, 17,618 commune) [**Perpignan**], and Millas (pop. 1881 town, 1970 whole commune), on the Tet; Thuir (pop. 2069 town, 2197 whole commune), on the Canals; Elne (pop. 1921 town, 2093 whole commune), on the Tech; Caudiés, St. Paul de Fenouillet (pop. 1665 town, 1743 whole commune), La Tour de France, Estagel (pop. 2003), and Rivesaltes (pop. 3208), on the Gly.

At Thuir, paper is manufactured from straw and leather. A battle was fought near this town in 1793, between the French and Spanish armies. Elne is of great antiquity; it was known to the Romans by the name of Illiberis, and subsequently of Helena, from the mother of the emperor Constantine, who rebuilt it and gave it her own name. Hannibal encamped under its walls. (Livy, lib. xxi., c. 24.) It was formerly an episcopal city, and a place of strength, but has been ruined by successive sieges. The see was transferred to Perpignan in 1604; but the antient cathedral is still standing. At St. Paul de Fenouillet some trade is carried on in Spanish wool. Rivesaltes is in a fertile plain surrounded by vine-clad hills. Part of the town is within the walls, and part without; the latter is the better built. The townsmen trade in the excellent liqueur wines produced in the neighbourhood and in brandy.

In the department of Céret are—Céret (pop. in 1831, 2651 town, 3251 whole commune; in 1836, 3302 commune), Prats de Mollo (pop. 3484), Arles (pop. 1792 town, 2166 whole commune), and Le Boulou, all on the Tech; St. Laurens or Laurent (pop. 3119 town, 3207 whole commune), on a feeder of the Tech; Bellegarde, on the Col de Pertus in the Pyrenees; and Argelès, Collioure, and Port Vendre, on or near the coast. Céret has a bridge of one arch over the Tech, on the right bank of which river the town is built. It has a court of justice and a high school. The town is surrounded by lofty antient walls. Prats de Mollo was fortified in 1100, and again in 1679 with the addition of fort La Garde, after the plans of Vauban. It was unsuccessfully besieged by the Spaniards in 1793. There is a stone bridge over the Tech, an hospital, and barracks. Coarse woollen cloth, blankets, and hosiery are manufactured; and considerable trade in these articles is carried on. There are mineral waters at Arles. Cork is prepared at Le Boulou. Bellegarde was regularly fortified by Louis XIV., and is a place of strength, and of importance from its position. It was taken by the Spaniards in 1793, and retaken in 1794 by the French under Dugommier. Collioure is defended by an old wall, and by a castle and three forts built on the neighbouring heights. The streets are narrow. The church is built on the sea-shore. There is a school of navigation, and there are two ropewalks. The townsmen carry on some trade with Spain, and are engaged in the pilchard fishery. Port Vendre has a safe harbour capable of containing 500 vessels; the entrance is defended by four batteries, in one of which is a lighthouse: on the land side the town is protected by Fort St. Elme on the west, and by another fort on the south. The townsmen (who amount to 2000 or more) carry on trade in corn, wine, brandy, woollen stuffs, and hardwares. Port Vendres which was previously of no importance, owes its prosperity to the Maréchal de Mailly, who repaired its harbour. Both this town and Collioure were taken by the Spaniards in 1794, and retaken the same year by the French.

In the arrondissement of Prades are—Prades (population in 1831, 2708 town, 2836 whole commune; in 1836, 3013 commune), Montlouis, Olette, Villefranche, Vinçac or Vinça (population, 1883 town, 2004 whole commune), and Ille (population, 2914 town, 3102 whole commune), all on the Tet; Mosset, near the foot of the Corbières, on a feeder of the Tet; Sournia, on the Desix, a feeder of the Gly; and Livia, in French Cerdagne, on the Sègre. Prades is a small ill-built town, but very clean, in a valley on the right bank of the Tet. It has a court of justice, one or two fiscal government offices, a seminary for the priesthood, and a high school. The townsmen manufacture coarse woollen cloth, woollen hosiery, and paper, and carry on trade in wine, wool, hemp, pulse, and iron. A great number of sheep, whose wool is of excellent quality, are fed in the neighbourhood. Prades was taken by the Spaniards in 1793, and retaken the same year. Montlouis has the most elevated site of any town in France, and indeed in all Europe. It was fortified by Vauban, by order of Louis XIV. It has a quadrangular citadel. The town is well laid out, with eight streets and several places or squares, of regular form; the esplanade is extensive and well arranged. The works are chiefly built of granite. There are a military hospital and very fine barracks. Olette has warm mineral springs, but they are of little note. Villefranche has two stone bridges over the Tet. The town, which is very small, having but two streets, is defended by a wall flanked at the angles with bastions, and also by a strong castle, built by order of Louis XIV. There are barracks and a military hospital. Marble and variegated breccia are quarried in the neighbourhood. Vinçac or Vinça is surrounded by an old wall, and has two suburbs larger and handsomer than the town itself, which is ill laid out and ill built; there are fountains of excellent water in the street. There is an hospital or almshouse. Iron-ore is obtained in the neighbourhood. Ille is surrounded by walls flanked by towers; it is a well-built town, with three churches and an hospital. Considerable trade is carried on in the fruit produced in the surrounding district, and there are two yearly fairs for cattle and agricultural produce. Livia has an antient parish church and the ruins of an old castle. The townsmen manufacture hosiery. The possession of this little town, which is in French Cerdagne, close upon the frontier, is by some of our authorities assigned to Spain.

The department constitutes the diocese of Perpignan, the bishop of which is a suffragan of the archbishop of Alby; it is in the jurisdiction of the Cour Royale and in the circuit of the Académie Universitaire of Montpellier, and in the tenth military division, the head-quarters of which are at Toulouse. The department sends three members to the Chamber of Deputies. In respect of education it is below the average of the departments; of the young men enrolled in the military census of 1828-29, thirty-one in every hundred could read and write, the average of the departments of France being more than thirty-nine.

In antient times this department constituted the territory of the Sardones; perhaps some parts of the northern boundary may have been within the limits of the Atacini (the people who dwelt about the Atax or Aude), who were, as well as the Sardones, a Celtic, or possibly a Ligurian people. These nations were early subdued by the Romans, who possessed the whole of the Mediterranean coast before the proconsulship of Cæsar in Gaul; they were consequently included in the 'Provincia' of that writer, afterwards distinguished as the Provincia Narbonensis; and on the subdivision of that province they were included in Narbonensis Prima. The Tet was the Telis of the Romans; the Tech, the Tichis; the Verdoubre, or Verdouble, a feeder of the Gly, and perhaps the lower part of the Gly itself, was the Vernodubrum of Pliny; and the Aude, the Atax. Several Roman towns or posts were within the limits of the department. Ruscino is mentioned by Polybius and Livy, in describing the march of Hannibal. The Gallic chieftains of the district assembled here, on the approach of the Carthaginian army, to deliberate on the part they should take. (Livy, lib. xxi., c. 24.) The name is variously written by antient authors. All that now remains of it is an old tower, two miles from Perpignan, called La Tour de Roussillon, which province obtained its name by a corruption of the antient Ruscino, which in the middle ages was called Rosciliona. Perpignan grew out of the ruin of Ruscino, which was ruined by the Normans.

The Combusta of the 'Itinerary' of Antoninus was north of Ruscino; the Salsulae of Mela may be identified with the modern Salces, on the west side of the Etang de Leucate, not only by the name, but by the occurrence of a phenomenon mentioned by the Roman geographer, viz. the occurrence of springs producing water salter than the sea. The Ad Stabulum of Antoninus has left a fragment of its name in Le Boulou, on the Tet; the Ad Centuriones of Antoninus (the Ad Centenarium of the Peutinger Table) was probably near it; and the Summus Pyrenaeus, which is marked by Antoninus on the route from Narbo and Ruscino into Spain, may be identified with the Col de Pertus, at the fortress of Bellegarde. The Portus Veneris of Mela and the Fanum Veneris of Strabo, Pliny, and Ptolemy, are easily recognizable in Port Vendre; and Illiberis, afterwards Helena (as already noticed), is the modern Elne. The Etang de Leucate is mentioned by Festus Avienus under the name of Stagnum Fordicen, or, according to the correction of Isaac Vossius, Sordicen. The same writer (Festus Avienus) applies the term Cyneticum Littus to the coast near the foot of the Pyrenees.

On the downfal of the Roman empire this territory came into the hands of the Visigoths, and was for several centuries attached to their monarchy; it was taken from them by the Moors, and from the Moors by the Franks. In the middle ages it was known as the province of Roussillon, and was alternately possessed by France and by Aragon (subsequently by Spain) until 1640, when it was finally incorporated with France.

PYRE'NE'ES SUPE'RIEURES, referred to by oversight instead of PYRENEES, HAUTES.

PYRENESTES, Mr. Swainson's name for a subgenus of *Coccothraustes*. [FRINGILLIDÆ.]

PYRGI'TA. [SPARROW.]

PYRGO, a genus of microscopic FORAMINIFERA.

PYRGO'MA. [CIRRIPEDA, vol. vii., p. 209.]

PYRGO'TELES, the most eminent engraver of gems of his age. He was a native of Greece, but the place of his birth is not recorded. He was contemporary with the most distinguished artists who were living in the last period of fine art in Greece, and after whom that which is termed the *high* style deteriorated. The leading sculptors of the time were Lysippus, Scopas, and their followers; Apelles and Protogenes were the chief painters; and Pyrgoteles ranked in his own art equally with those celebrated names. Alexander the Great conferred the same honour upon Pyrgoteles that was extended to Lysippus and Apelles, who had the exclusive privilege of representing him in their respective arts. In like manner he forbade any artist to engrave gems of him but Pyrgoteles. 'Idem hic Imperator edixit ne quis ipsum alius quàm Apelles pingeret; quàm Pyrgoteles sculperet; quàm Lysippus ex ære duceret.' (Plin., *Hist. Nat.*, vii. 37.) Again, '—— edictum Alexandri Magni quo vetuit in gemmâ se ab alio sculpi quàm à Pyrgotele.' (xxxvii. 1.)

No well-authenticated work of Pyrgoteles has reached our times. Some writers have supposed that two gems might be attributed to him (Bracci, *Memor.*, tab. 98, 99), but this opinion has been successfully disputed, and is no longer entertained by antiquaries.

PYRI'TES, COPPER. [COPPER—*Ores.*]

PYRI'TES, IRON. [IRON—*Ores.*]

PYRMONT is a county belonging to the Prince of Waldeck, about 35 square miles in extent, with 6000 inhabitants, the majority of whom are Protestants, whose chief occupations are agriculture and the breeding of cattle. It is very mountainous and wooded. It yields the prince a revenue of about 8500*l.* per annum, of which the mineral springs alone produce nearly 2000*l.*

PYRMONT, the capital, is a well-built open town, at the northern extremity of a romantic valley on the banks of the river Emmer. The principal street, shaded on both sides by lofty lime-trees, leads to the great avenue and to the celebrated mineral springs, of which there are four. The principal spring, called in former times the Holy Spring, rises at the upper end of the great avenue. The wate [illegible] as clear as crystal, and has a refreshing taste. With respect to strength and salutary effect on the human body, it has preserved for some centuries the advantage over all other known chalybeate springs. It never freezes. Above 350,000 bottles are annually exported to all parts of the world. The Brodel Brunnen is used only for bathing, the water not being quite clear. The great avenue, 500 paces long and 40 broad, and planted with four rows of fine lime-trees, is the chief place of resort of the visitors, who are very numerous, being about 2000 in a year, and in some years 2500 and more, besides the country-people. On the two sides of the avenue are the coffee-house, the theatre, the assembly-rooms, and a great number of shops. Near it is the great bathing-house, which contains 140 apartments, tastefully fitted up, and handsome spacious baths. There is likewise a salt spring at which other baths have been fitted up. A few hundred paces from the great avenue stands the palace of Pyrmont, which has been the residence of the Prince of Waldeck ever since 1806. In a valley near Pyrmont there is a colony of Quakers, called Friedensthal. (Menke, *Pyrmont und seine Umgebungen*; Pittmann, *Pyrmont.*)

PYROCHLORE occurs in octohedral crystals. Primary form a cube. Cleavage parallel to the faces of a regular octohedron, but very difficultly obtainable. Fracture conchoidal, with a lustre between vitreous and resinous. Hardness 5·0. Colour reddish brown or black. Streak pale. Translucent, opaque. Specific gravity 4·206 to 4·216.

Infusible by the blowpipe; becomes greenish-yellow by calcination. Found at Fredrichswärn in Norway, and in Siberia.

Analysis by Wöhler:—Titanic acid, 62·75; lime, 12·85; oxide of cerium, 6·80; oxide of uranium, 6·18; oxide of manganese, 2·75; oxide of iron, 2·16; oxide of tin, 0·61, water, 4·20.

PYROLIGNEOUS ACID. [Acetic Acid.]

PYROLUSITE. [Manganese.]

PYRO'METER (literally, 'fire-measurer,' from πῦρ, 'fire,' and *μέτρον*, 'a measure'). No fluid has hitherto been found applicable to the construction of thermometers capable of indicating higher temperatures than that of boiling mercury (about 650° Fahr.). The term pyrometer was first employed by Musschenbroek to designate an instrument invented by him for measuring the effects produced in the dimensions of solid bodies by the application of heat; but the signification of the term has since been extended so as to include those instruments the object of which is to measure all gradations of temperature above those which can be indicated by the mercurial thermometer.

Musschenbroek's pyrometer consisted of a metallic bar, about six inches in length, one extremity of which was fixed, while the other was left free to advance as the metal elongated from the effect of several spirit-lamps placed beneath, which, at each experiment, were charged with the same quantity of highly rectified spirit of wine. The advance of the moveable extremity gave motion to a pinion and wheel, the latter of which drove an index over a graduated circle, each degree of which corresponded to a linear expansion of 12,500th of an inch. The instrument, as it was originally constructed, is described in the second part of Musschenbroek's translation of the 'Saggi di Naturali Esperienze fatte nell' Academia del Cimento,' Leyden, 1731; and as improved by Desaguliers (who substituted fine cords and friction-rollers for the wheel and pinion), in the first volume of his 'Experimental Philosophy,' p. 444.

To Musschenbroek's pyrometer succeeded those of Ellicott (described in the 'Philosophical Transactions' for 1736, p. 297, and 1751, p. 485), Graham ('Phil. Trans.,' 1754, p. 598), Smeaton, Ferguson ('Lectures,' vol. i., pp. 14 and 301), &c., which, like those that have since been constructed, with few exceptions, down to the present time, evince but little originality in the principle upon which they rest. A bar of metal is in most cases subjected to the direct action of flame, or immersed in a fluid of convenient temperature. The minute resulting expansion is multiplied, and thereby rendered appreciable by the intervention of a succession of levers or a system of wheels and pulleys. Supposing this intervening machinery to perform with theoretical accuracy, and that the same quantity of heat is successively communicated to different substances, the indications of such an instrument would give the relative expansions of those substances under the same circumstances. But where wheels, pinions, levers, &c. are employed, there must be considerable liability to error, arising from flexure, obliquity of action, and other causes, the magnitude of which it would be difficult to estimate, and which, even if it be supposed small in the first instance, will be magnified almost in the same proportion as the delicacy of the instrument is increased. Moreover the substance itself, if its nature be such as to be softened by heat, is very liable at high temperatures to undergo compression in giving motion to the machinery. Even therefore as measures of expansion they cannot be considered as deserving of much confidence. A similar remark is applicable, though in a less degree, to the contrivance employed by Lavoisier and Laplace, in which the expansion of the metal deflected a telescope from the position that it had at the commencement of the experiment, and the absolute expansion was deduced from the extent of this deflexion, which was read off upon a graduated scale placed at a considerable distance in front of the telescope. See a description of the apparatus employed in Biot's 'Physique Experimentale,' tome i., pp. 207-9, where also is given a table of the expansions of the several substances experimented on between the temperatures of 32° and 212° Fahr. Troughton, in 1794, constructed an instrument which bore some resemblance to the preceding, the principal difference consisting in the employment of a spirit-level, the deviations of which from the horizontal determined the expansion of the metal.

The 'Phil. Trans.' for 1777 contain a description of the method employed by De Luc in the construction of his compensating pendulums, in order to determine the length of one metal whose expansion is equal to a given length of another metal. For this purpose he suspended the bar of known length from an arm, projecting horizontally from an upright deal plank. To the lower extremity of this bar was adjusted a small horizontal platform, upon which a bar of the other metal rested in a vertical position. Upon raising the temperatures of both bars, every point on the surface of the second bar would obviously become subjected to two motions tending to move it in opposite directions; it would be depressed by the expansion of the first bar, and elevated by the expansion of the second. One point would therefore remain stationary, and this point, being ascertained by raising or lowering a microscope adjusted to the edge of the plank, determined the portion of the second bar, measured from its lower extremity, whose expansion was equal to the whole of the first bar.

The rods employed by Borda in measuring the base-line of the great French Survey consisted of a rule of brass laid upon a somewhat longer rule of platinum and attached at one extremity. The portion of the platinum rule not covered by the one of brass was divided into millionths of the entire length of the rule, and further subdivided by means of a vernier and microscope adjusted to the extremity of the brass rule. The value of each of these divisions having been previously ascertained by first surrounding the compound rule with melting ice, and then immersing it in boiling water, it was only necessary to observe the indications of the vernier in order to apply the requisite correction for reducing the length of the rod to the standard temperature.

For low temperatures, the contrivance of Ramsden, described in the 'Philosophical Transactions' for 1785, and employed by General Roy in determining the expansion of the rods used in measuring the base on Hounslow Heath for the Trigonometrical Survey, was perhaps unexceptionable. The rod was immersed in a trough of water, and over each extremity was placed a microscope, to which a slow motion could be given in the direction of the length of the rod by means of a fine micrometer screw. The lines of collimation of the microscopes being thereby adjusted at the commencement of the experiment so as to accurately coincide with two points near the extremities of the rod, the temperature of the water was gradually raised, till a thermometer placed in the trough indicated an advance of 10°, 20°, 30°, or any required number of degrees. The consequent elongation of the rod destroyed the coincidence of its extremities with the lines of collimation of the microscopes, which was re-established by turning the micrometer screws, and carefully noting the number of turns and fraction of a turn necessary for that purpose; when, the value in parts of an inch of each turn being previously known, a direct measure of the expansion was obtained, free from the errors of a system of levers or of a train of wheels and pinions.

The property of alumina whereby it undergoes a diminution of bulk when heated, was employed by Wedgwood as a measure of high temperatures. His pyrometer consisted of cylinders of fine white clay, and an apparatus for accurately measuring their length. This apparatus consisted of a metallic plate, upon which were fixed two brass rules slightly inclined to each other. The rules used by Wedgwood were 24 inches long, and divided into 240 equal parts. The distance between the rules at one extremity was three-tenths and at the other five-tenths of an inch; consequently the difference between their distances at any two consecutive divisions was the 1200th part of an inch. But it is obvious that these numbers are quite arbitrary; and that by increasing the length of the rules and diminishing their inclination, the difference between their distances at any two consecutive divisions may be made as small as we please. The clay cylinders were first baked at a red heat, estimated at 947° Fahr., and then reduced to exactly five-tenths of an inch in length, so as to fit the first division of the scale. When afterwards exposed to a greater heat, they underwent contraction, and the amount of this contraction was determined by observing the division of the scale corresponding to their diminished length. If we then assume, with Wedgwood, that the contraction is proportional to the temperature at which it took place, the latter will likewise be determined; but independently of the difficulty of procuring pieces of clay of uniform composition, from which it resulted that two cylinders of equal length when exposed to the same heat seldom underwent the same degree of contraction, it has been found that the duration of the experiment has considerable influence upon the contraction, the longer continuance of a low temperature producing the same contraction as a higher degree of heat continued for a shorter time. As a measure of temperature therefore this method cannot be relied on, though as a direct measure of expansion we doubt if it has been surpassed either in the simplicity of its principle or in the minuteness of the indications of which it is susceptible. A description of the instrument and of the experiments made with it will be found in the *Philosophical Transactions* of 1782, 1784, and 1786.

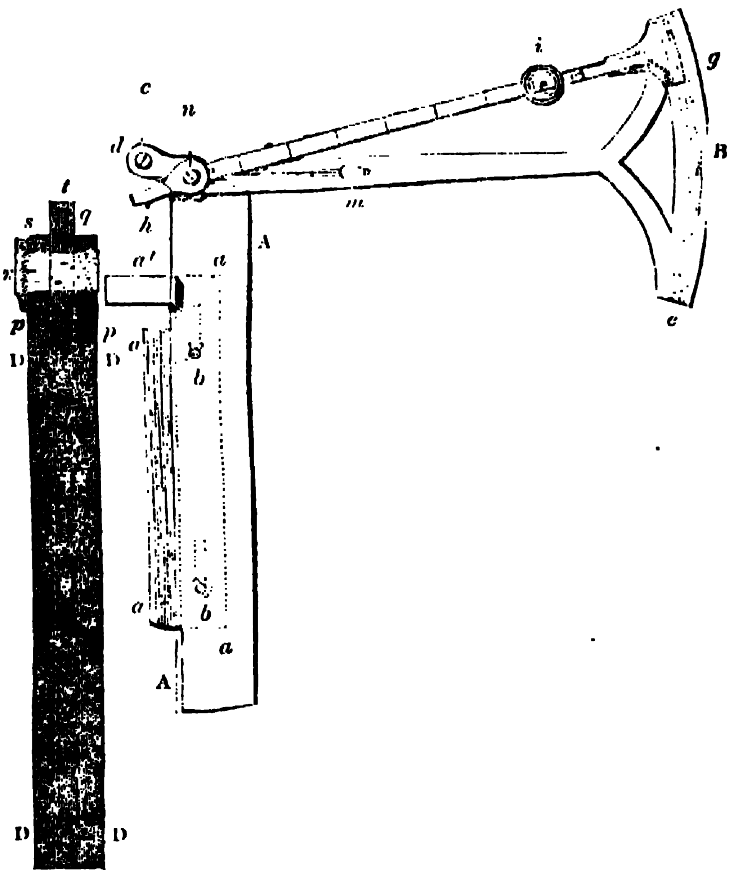
A pyrometer was constructed by Achard, similar in form and principle to the common thermometer, but intended to indicate much higher degrees of heat. It consisted of a bulb and graduated tube of semi-transparent porcelain highly baked, and containing a very fusible alloy, composed of bismuth, lead, and tin, which became liquid at about 212°, and indicated higher temperatures by its expansion, which was visible through the semi-transparent tube.

Dulong and Petit employed a very direct mode of measuring the absolute, not linear, expansions of various substances. By observing the difference of altitude at which mercury of different temperatures stood in the two arms of an inverted glass siphon, they determined the absolute expansion of the mercury, and by comparing this with the apparent expansion of mercury in a glass tube, they deduced the absolute expansion of the glass. A cylinder of the metal whose expansion was sought was then placed within a glass tube, closed at one extremity and terminating at the other in a capillary opening, and the rest of the tube occupied with mercury. Upon the whole being heated, a portion of the mercury was expelled equal to the excess of the absolute expansions of the mercury and metal above that of the glass; and as the expansions of the mercury and glass were previously known, the weight of the expelled mercury determined the expansion of the metal.

Dr. Brewster has proposed to measure expansions by the number and intensity of the polarized tints produced by the inflexion of a plate of glass against which the expanding substance is made to press. The reader will find some account of this in Brewster's 'Cyclopædia' under the articles 'Pyrometer' and 'Optics.'

Guyton's pyrometer, which was exhibited before the National Institute in 1803, and described in the 'Annales de Chimie,' xlvi., p. 276, and in Nicholson's 'Philosophical Journal,' vi., p. 89, consisted of a bar of platinum nearly two inches in length, placed in a groove of porcelain. One extremity of the bar rested against the solid end of the groove, while the other pressed upon the short arm of a lever, the longer arm of which carried a vernier over a graduated circular arc. The whole was constructed of platinum, and a spring was made to press upon the vernier to prevent its displacement while in the act of withdrawing the instrument from the furnace. The indications of the vernier at the commencement and termination of the experiment were the data from which the expansion was subsequently computed. 'The defect of this instrument,' observes Mr. Daniell, 'arose from the nature of platinum, which at a red heat becomes soft and ductile, so that the lever would be liable to bend, and thereby frustrate the experiment; and this is supposed to have been the reason why the inventor never extended his experiments to temperatures higher than that of the melting point of antimony.

As early as 1821, the last-named gentleman, Mr. Daniell, the present Professor of Chemistry at King's College, London, had invented an instrument which, he states, 'afforded correct determinations connected in an unexceptionable manner with the scale of the mercurial thermometer;' but it was only suited to the experimental furnace of the chemist, so that, he continues, 'the great desideratum still remained of a pyrometer which might be universally applied to the higher degrees of heat, as the thermometer had long been to the lower, and which, in addition to its use in delicate researches, might effect for the potter, the smelter, the enameller, and others, in the routine of their business, what the latter daily performs for the brewer, the distiller, the sugar-refiner, and the chemist.' The annexed diagram represents the second pyrometer invented by Mr. Daniell, for which the Rumford medal was awarded to him by the Royal Society. A description of it is given in the 'Philosophical Transactions' for 1830, and an account of the experiments made with it is inserted in the 'Transactions' of that and the following years.



It consists of two distinct parts, the register and the scale. The register is a solid bar of black-lead earthenware, DDDD, eight inches long and seven-tenths of an inch wide and thick, cut out of a common black-lead crucible. In this a hole is drilled three-tenths of an inch in diameter, and seven inches and a half in depth. At *pp* the upper end of this bar, and on one of its sides about six-tenths of an inch in length of its substance, are cut away to the depth of half the diameter of the bore. When a bar of any metal six inches and a half long is dropped into this cavity, it rests againsts its solid end; and a cylindrical piece of porcelain, *q*, about one inch and a half long, called the index, is placed on the top of it, which, projecting into and beyond the open part, is firmly confined to its place by a strap of platinum, *r*, which passing round the black-lead bar and over the piece of porcelain, is made to press upon the latter with any required degree of tension by means of a small wedge *s* of porcelain inserted between the bar and the strap. When the register is exposed to the heat of a furnace, it is evident that, the expansion of the metallic bar exceeding that of the black-lead, the porcelain index will be forced forward; and when the register is afterwards cooled, the tension of the strap will retain the index at the point of greatest elongation.

The object of the scale is the accurate measurement of the distance through which the index has advanced. It consists of a frame *aaaa* composed of two rectangular plates of brass joined at right angles by their edges, and fitting square upon two sides of the register. At one extremity of this frame is a small plate of brass *a'*, which, when the two former plates are applied to the register, is brought down upon the shoulder formed by cutting away the black-lead at *p*, and the whole may be thus firmly adjusted, when required, to the black-lead bar by three planes of contact. To the outside of this frame is firmly attached, by means of the screws *bb*, a brass plate AA, the extremity of which *d* projects so that a point *c* near to it may be immediately opposite to the cavity in the black-lead bar when the latter is adjusted to the frame. About *c* as a centre, turns an arm *dn*B slightly bent at *n*, carrying at its extremity a graduated circular arc *ee*. The radius of this arc is five inches, and its moveable centre *n* is distant from the fixed centre *c* exactly half an inch. About *n* turns a straight and lighter arm *hg*, five inches and a half in length, the distance from *h* to *n* being half an inch. The extremity *g* of this arm carries a vernier, by which the divisions of the graduated arc are subdivided into minutes, and also an eye-glass *i* to assist the reading. The other extremity terminates in a steel point *h*, or, as the instrument is now constructed, a knife-edge, which, when the register is adjusted to the frame, is inserted in a small cavity *t*, formed for its reception at the extremity of the porcelain index. A small steel spring let into the larger arm at *m* is made to press upon the lighter arm, whereby the latter has a constant tendency to move towards the commencement of the graduation.

When the instrument is used, the metallic bar to be experimented on is placed in the cavity of the register, and the index pressed down upon it and firmly fixed in its place by the platinum strap and porcelain wedge. The scale is then applied by carefully adjusting the frame to the register and fixing it by pressing *a'* upon the shoulder. Holding the whole together steadily in the left hand, the lighter arm is so placed that the steel point *h* may rest upon the edge of the index, against which it will be pressed by the spring: then by slightly turning the larger arm, the point will move along the surface of the index till it drops into the cavity *t*. The indications of the vernier being then read off, the register is detached from the scale, placed in the furnace, and after it is removed and cooled, it is again applied to the scale in the same manner as before, and the second indication of the vernier noted. From the two readings of the vernier may be deduced the excess of the expansion of the metallic bar above that of the black-lead, though a correct formula for this purpose has not, to the writer's knowledge, been hitherto given.

The one employed by Mr. Daniell, though probably sufficiently correct for all practical purposes, gives the expansions one per cent. too great without exception, and in many cases much more, so that more than the first *significant* figure can seldom be depended upon in those published by him in the 'Philosophical Transactions' of 1830-31. The error thus introduced is perhaps within the limits of the error to which the instrument itself is liable; but should this not be the case, it might be desirable to employ the correct formula, for which reason we subjoin its investigation.

Let *cn*B, *hng*, represent the positions of the two arms of the scale relative to the register, before the expansion has taken place, and *cn'*B', *h'n'g'*, their positions after the expansion; *h* and *h'* the two positions of the steel point, the line joining which passes through the fixed centre *c*; *e* and *e'* the two positions of the zero of the graduated arc. Put the angle $cn\mathrm{B} = cn'\mathrm{B}' = \alpha$; $en\mathrm{B} = e'n'\mathrm{B}' = \beta$; eng (the first reading of the vernier) $= \phi$; $e'n'g'$ (the second reading) $= \phi'$; also $cn = cn' = nh = n'h' = r$; and $hh' = \epsilon$, the excess of the expansion of the metal above that of the black lead: then

$$\epsilon = \frac{\sin hnn' - \sin h'n'n}{\sin h'hn - \sin hh'n'} \times \text{chord } nn';$$

$$\begin{aligned} \text{But}\quad hnn' &= 270^\circ - \alpha + \beta - \tfrac{1}{4}(3\phi + \phi');\\ h'n'n &= -90^\circ + \alpha - \beta + \tfrac{1}{4}(3\phi' + \phi);\\ h'hn &= \tfrac{1}{2}(\alpha - \beta + \phi);\\ hh'n' &= 180^\circ - \tfrac{1}{2}(\alpha - \beta + \phi');\\ \text{chord } nn' &= 2r\sin\tfrac{1}{4}(\phi' - \phi);\\ &= \sin\tfrac{1}{4}(\phi' - \phi), \text{ since } r = \tfrac{1}{2}. \end{aligned}$$

∴ substituting and reducing by means of the formula

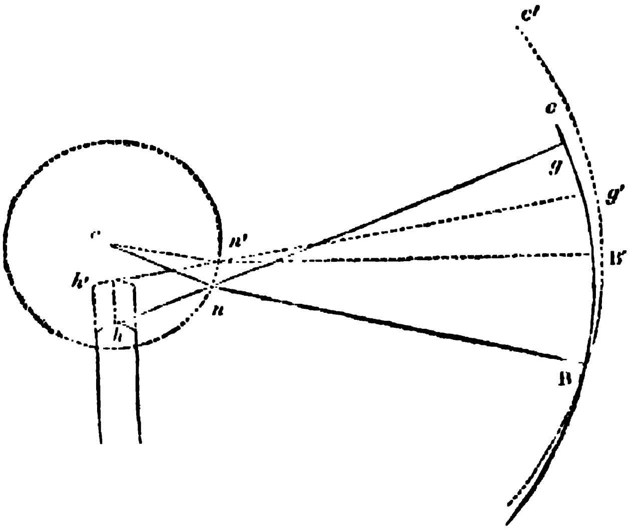
$$\sin \mathrm{A} - \sin \mathrm{B} = 2\cos\frac{\mathrm{A}+\mathrm{B}}{2}\sin\frac{\mathrm{A}-\mathrm{B}}{2}, \text{ there results}$$

$$\epsilon = 2\sin\tfrac{1}{4}(\phi' - \phi)\sin\{\tfrac{1}{2}(\alpha - \beta) - \tfrac{1}{4}(\phi' + \phi)\}$$

If $\alpha = 180^\circ$ and $\beta = 15^\circ$, as is nearly the case, this reduces to

$$\epsilon = 2\sin\tfrac{1}{4}(\phi' - \phi)\cos\{7^\circ\,30' + \tfrac{1}{4}(\phi' + \phi)\}.$$

where the unit of measurement is one inch.



The formula used by Mr. Daniell is $\epsilon = \sin\frac{1}{2}(\phi' - \phi)$, or its equivalent, since $\phi' - \phi$ is generally a smal angle, $\epsilon = 2\sin\frac{1}{4}(\phi' - \phi)$; from which it appears that all the expansions given by him should be diminished in the ratio of $1 : \cos\{7^\circ\,30' + \frac{1}{4}(\phi' + \phi)\}$; but as he has recorded only the difference $\phi' - \phi$ of the readings of the vernier, and not the readings themselves, this correction can only be made by a repetition of the whole of the experiments. The error is inconsiderable so long as ϕ and ϕ' are both small, but it increases with the increase of either of those angles.

The excess of the expansion of the metal above that of the black-lead being thus obtained, and increased by the expansion of the latter (the determination of which is less direct and conclusive), the expansion of the metal becomes known. In order that the instrument may then be employed as a measure of temperature as well as of expansion, the doubtful assumption is introduced that equal increments of length are the effects of equal increments of temperature, and thence, having determined the expansion between any two known points on the thermometric scale, say the temperatures of melting ice and boiling mercury, a mere proportion will of course give the temperature at which any other observed expansion took place.

It remains to notice a paper communicated to the Royal Society by the late Mr. Prinsep, the assay-master of the Mint at Benares, 'On the Measurement of high Temperatures,' and published in their 'Transactions' for 1828. 'The fusing-points of pure metals,' observes that gentleman, 'are determinate and unchangeable; they also comprehend nearly the whole range of temperature; the unoxidable or noble metals alone embrace a range from the low melting-point of silver to the high ignition of platina. There are it is true only three fixed points in this scale, but as many intermediate links may be made as are required, by alloying the three metals together in different proportions. When such a series has been once prepared, the heat of any furnace may be expressed by the alloy of least fusibility which it is capable of melting.' As the melting-points of silver and gold are comparatively near to each other, Mr. Prinsep assumed only ten intermediate gradations of heat, the lowest of which corresponded to the fusing-point of pure silver, and the others to the fusing-points of silver alloyed with 10, 20, 30, &c. per cent. of gold. From the melting-point of gold to that of platina, he assumed one hundred gradations of heat, which were the melting-points of pure gold and of gold alloyed with 1, 2, 3, &c. per cent. of platina. Among the advantages of this mode of identifying temperatures are:—the smallness of the requisite apparatus, nothing more being needed than a small cupel, containing in separate cells eight or ten pyrometric alloys, each of the size of a pin's head; the indestructibility of the specimens, since those melted in one experiment need only to be flattened under a hammer, when they will be again ready for use; and the facility of notation, since two letters and the decimal of alloy will express the maximum heat: thus S ·3 G expresses the temperature of the fusing-point of silver when alloyed with gold in the proportion of 7 to 3; and G ·23 P expresses the fusing-point of gold when alloyed with platina in the proportion of 77 to 23. For a more particular account of this mode of determining temperatures we refer the reader to the memoir cited.

Several suggestions have been made for employing the expansion of air, on the principle of the differential thermometer, as a measure of high temperatures. It is proposed that one-half of the instrument be composed of platinum, so as to fit it for exposure to a great heat, and the other part of glass. The suggestion, we believe, is originally due to Mr. Schmidt (Nicholson's *Journal*, xi., p. 141); but was brought forward under another form by Mr. Nicholas Mill, in the 'Monthly Medico-Chirurgical Review and Chemico-Philosophical Magazine,' vol. i., Lond., 1824; again by Dr. Ure, in his 'Dictionary of Chemistry;' and lastly by Mr. Prinsep. The instrument, we believe, has been constructed upon each of the plans proposed. That of Mr. Prinsep appears the most complete (see a drawing of the apparatus in full operation at page 87 of his Memoir above referred to), and was employed by him to connect the fusing-points of his alloys with the thermometric scale; but the principle upon which they all rest involves the assumption that the increase of temperature is proportional to the expansion of the air.

A valuable table of the expansions of different substances, collected from various sources by Mr. Francis Baily, is given in the first volume of the 'Transactions of the Astronomical Society,' p. 416.

(Biot's *Physique Experimentale*; *Philosophical Transactions*; Thomson's *Chemistry*; Brewster's *Cyclopædia*; *Encyclopædia Britannica*; and the works cited.)

PYROMORPHITE. [Lead—*Ores*.]

PYROPHYLLITE (*Radiated Talc*) occurs in fibrous radiating masses and small prisms of indeterminate form. Hardness 1·5. Colour light green. Lustre pearly, transparent in thin laminæ. Specific gravity 2·8.

Before the blowpipe, exfoliates into white leaves, but does not fuse. With borax, gives a green glass, which becomes colourless when cold; with soda, gives a transparent yellow glass. Occurs near Beresof, in the Uralian Mountains, Siberia.

Analysis by Hermann:—Silica, 59·79; alumina, 29·46; magnesia, 4·00; oxide of iron, 1·80; water, 5·62.

PYRORTHITE occurs imbedded in granite or quartz, in single or aggregated slender columnar masses. Fracture conchoidal, uneven, earthy. Hardness 2·5. Colour blackish brown. Lustre resinous. Opaque. Specific gravity 2·19.

When cautiously heated by the blowpipe it takes fire and burns without either flame or smoke; it afterwards becomes white, and eventually fuses into a black enamel. With borax it gives a transparent glass. Dissolves in acids when heated, except a black powder. It is found near Fahlun in Sweden.

Analysis by Berzelius:—Silica, 10·43; oxide of cerium, 13·92; oxide of iron, 6·08; yttria, 4·87; alumina, 3·59; lime, 1·81; oxide of manganese, 1·39; water, 26·50; carbon and loss, 31·41.

PYROSMALITE occurs crystallized in hexagonal prisms. Primary form a rhomboid. Cleavage distinct, perpendicular to the axis; indistinct, parallel to the planes of the prism. Fracture uneven, conchoidal. Hardness 4·0 to 4·5. Colour greyish yellow. Streak pale. Lustre vitreous, pearly on the cleavage faces. Translucent, opaque. Specific gravity 3·08. When heated in a tube, yields water. Heated with borax, dissolves readily, and exhibits the characteristic colours of iron.

It is found at Nordmark in Sweden.

Analysis by Hisinger:—Silica, 35·850; muriatic acid, 14·095; protoxide of iron, 21·810; protoxide of manganese, 21·140; lime, 1·210; water, 5·985.

PYROSO'MA. [Salpacea.]

PYROXENE. This mineral has received various names, probably because it has been found in different countries, and under slightly varying circumstances and properties the different names by which it has been known are *Alalite*: *Augite*, *Baikalite*, *Coccolite*, *Diopside*, *Fassaite*, *Jeffersonite*, *Malacolite*, *Mussite*, *Pyrgom*, and *Sahlite*.

Primary form an oblique rhombic prism. Cleavage parallel to the lateral planes and both diagonals. Fracture uneven, conchoidal. Hardness 5·0 to 6·0. Colourless, grey, black, brown, yellow, green of many shades. Streak paler. Lustre vitreous and vitreo-resinous. Transparent to opaque. Specific gravity 3·23 to 3·35.

Massive Varieties, amorphous. Structure granular, columnar, parallel, and radiating, laminar.

Found in lava and basaltic rocks, and the older rocks in most parts of the earth.

Analysis of the variety called Augite, from Etna, by Vauquelin:—Silica, 52; lime, 13·20; magnesia, 10; peroxide of iron, 14·66; alumina, 3·33; oxide of manganese, 2.

The results of the analysis of the different varieties vary considerably, especially in the proportion of oxide of iron, lime, and magnesia.

PYROXYLIC SPIRIT. This substance was discovered by Mr. Philip Taylor in 1812, but not described by him till 1822, when he gave an account of it in the 'Philosophical Magazine' for that year, under the name of *pyroligneous æther*: its present appellation was given to it by Macaire and Marcet.

When wood is distilled for the purpose of preparing pyroligneous or impure acetic acid, pyroxylic spirit is also formed, and found in the liquid distilled: when this is subjected to rectification, the first tenth part of the product contains the spirit in question. It is purified by repeated rectifications, the last being made over lime, by which a quantity of ammonia is set free that had existed in the state of acetate. Dr. Kane purified it by rectification with chloride of calcium.

The properties of this substance are, that when pure it is colourless, has a peculiar penetrating smell, partaking both of alcohol and æther, and its taste is pungent: its specific gravity at 68° is 0·798, and that of its vapour at 212° is 1·120, that of the vapour of water = 1. It boils at about 150° Fahr. It does not become coloured by exposure to light and air, mixes with water without being rendered turbid, has no action upon vegetable colours, and does not form a black precipitate with protonitrate of mercury. It is an extremely inflammable liquid, and burns without residue; and being cheaper than spirit of wine, it is advantageously substituted for it in spirit-lamps, and for the purpose of dissolving resins in rendering certain manufactures water-proof; it is especially employed for this purpose in hat-making. Pyroxylic spirit is similar to alcohol in many of its properties: in density, volatility, inflammability, the solution of resins, and miscibility in all proportions with water: they differ however in one very remarkable circumstance, which is, that pyroxylic spirit yields no æther by the action of acids.

This spirit has been analyzed by Kane, and by Dumas and Peligot, with results which very nearly agree:—

	Kane.	Dumas and Peligot.		
Hydrogen . .	12·39	12·46	or 2 eqs.	12·5
Carbon . .	37·15	37·22	„ 1 eq.	37·5
Oxygen . .	50·46	50·32	„ 1 eq.	50
	100·	100·		100·

Dumas and Peligot consider pyroxylic spirit as containing a peculiar carburetted hydrogen, which they call *methylene*, and which is in fact a dicarburet of hydrogen, similar in composition to light carburetted hydrogen gas. It is capable of combining with chlorine, iodine, and other elementary bodies; it unites also with acids to form various compounds. and pyroxylic spirit is an oxide of this carburetted hydrogen.

PYRRHO, a Greek philosopher, and founder of the Pyrrhonian or first Sceptic school, was the son of Pleistarchus, or Pleistocrates, and a native of Elis, a town of Peloponnesus. He lived about the time of Philip and Alexander of Macedonia, and was originally a poor painter; but after having learned the elements of science from Dryson, he followed Alexander the Great in his eastern expedition, and thus became acquainted with the doctrines of the Indian gymnosophists and the Persian magi. (Diog. Laert., ix. 11, 2.) He was also an ardent admirer of Democritus. During the greater part of his life he lived in quiet retirement, abstaining from pronouncing any decided opinion upon anything, and endeavouring to preserve the greatest calmness and composure in whatever circumstances he was placed, so that neither pain nor pleasure affected him. Notwithstanding this apparently inactive and indolent mode of life, he was highly honoured by his countrymen, who not only made him their high-priest, but, for his sake, decreed that all philosophers should be exempt from the payment of taxes. (Diog. Laert., ix. 11, 5.) Pausanias (vi. 24, 4) saw his statue in a portico at Elis, and a monument erected in honour of him at a little distance from the town. The Athenians honoured him with the franchise of their city, though the motive which Diogenes Laertius gives for it is a mere fable. He died at the advanced age of ninety.

An undisturbed peace of mind (*ἀπαθία*) appeared to him the highest object of philosophy; and thinking that this peace of mind was disturbed by the dogmatic systems and the disputes of all other philosophic schools, he was led to scepticism, which he carried to such a degree, that he considered a real knowledge of things to be altogether impossible, and virtue to be the only thing worth striving after. (Cic., *De Fin.*, iv. 16.) On all occasions therefore he answered his opponents, 'What you say may be true, but I cannot decide.' This and other similar expressions drew upon him the ridicule of his adversaries; and most of the absurd anecdotes respecting his conduct in the common occurrences of life, which Diogenes repeats with all the credulity of a gossip, are probably the fabrications of his opponents, made for the purpose of ridiculing Pyrrho. He had many distinguished followers and disciples, who are called Pyrrhonii, or simply Sceptics: some of them are mentioned and characterised by Diogenes Laertius (ix, c. 7, &c., and c. 12; comp. *Gellius*, xi. 5: and Cic., *De Orat.*, iii. 17). Their doctrines and mode of reasoning are seen clearest in the works of Sextus Empiricus: their object was rather to overthrow all other systems than to establish a new one; hence we can scarcely speak of a school of Pyrrhonists, inasmuch as they opposed every school. The whole philosophy of Pyrrho and his followers is called Pyrrhonism, a name which, in subsequent times, has been applied to any kind of scepticism, though the Pyrrhonian philosophy in reality is only one particular and an elementary form of scepticism. Cicero, in several passages, speaks of the philosophy of Pyrrho as long exploded and extinct. Pyrrho himself is said by some antient authors to have left no works behind him; the tropes, or epochs, or fundamental principles of his philosophy, being justly ascribed to one or more of his followers. But Sextus Empiricus (*Adv. Math.*, i. 282) says that he wrote a poem addressed to Alexander the Great, for which he was richly rewarded: and Athenæus (x., p. 419) quotes a passage from a work of Pyrrho, the character of which is entirely unknown. The first writer on the scepticism of Pyrrho is said to have been Timon, his friend and disciple, whose life is written by Diogenes Laertius.

PYRRHOCERAS. [CORVIDÆ, vol. viii., p. 72.]

PY'RRHOCORAX. [CORVIDÆ, vol. viii., p. 72.]

PYRRHO'DES. [PSITTACIDÆ.] Mr. Swainson's generic character is as follows:—

Bill and general structure as in *Lorius*. Tail cuneated, very long; the feathers narrow and pointed; the two middle pairs greatly exceeding the others.

Locality.—Indian Islands.

Example, *Pyrrhodes Papuensis*, Le Vaill, i., pl. 77.

PY'RRHULA. [BULLFINCH.]

PYRRHULI'NÆ, Mr. Swainson's name for a subfamily of *Fringillidæ*, comprising the genera *Pyrrhulauda*, Smith; *Pyrrhula*, with subgenera *Crithagra* and *Spermophila*; *Psittirostra*; *Corythus*; *Hæmorhous*, Sw.; and *Loxia*, Linn.

PYRRHULAUDA. The following is the generic character:—

Bill short; the sides much compressed; the tip entire; the culmen arched; commissure straight. Nostrils concealed by the frontal feathers. Wings moderate; the first quill very small and spurious; the three next equal, and longest. Tail moderate, slightly forked. Feet black. Tarsi moderate. Toes very small. Lateral toes equal. Hinder claws lengthened, slightly curved. Smith. (Sw.)

Example, *Pyrrhulauda leucotis*, 'Pl. Col.' 269, f. 2.

PY'RRHUS, king of Epirus, born about the year 318 B.C., was the son of Aeacides and Phthia, daughter of Meno the Thessalian, who distinguished himself in the Lamian war. The fabulous genealogies of his family traced his origin back to Neoptolemus, whose father Achilles is said to have been honoured as a god by the Epirotæ under the name of Aspetus. Aeacides, who had come to the throne after the death of Alexander the Molossian, excited discontent among his subjects by his constant wars against the Macedonians, and was in the end driven out of his kingdom. (Justin, xvii. 3.) His only son Pyrrhus, then two years old, would have been put to death but for the care of a few friends, who, with the greatest difficulty, saved the child's life. Pyrrhus was carried to Glaucias, king of the Illyrians, whose wife belonged to the family of the Aeacidæ, and who received the infant prince, and had him educated with his own children. Great offers were made to Glaucias to induce him to surrender the child, but in vain. In his house Pyrrhus remained until his twelfth year. Aeacides, who had in the meanwhile returned to his country, fell in a battle against Cassander; and Glaucias now, with an armed force, led Pyrrhus back to Epirus, and the Epirotæ gladly received the young prince as their king. (Plut., *Pyrrh.*, 3; Justin, xvii. 3.) A regency was appointed, who governed the kingdom in his name. When Demetrius, the chief adversary of Cassander, was obliged to withdraw his forces from Europe to Asia, Cassander contrived to induce the Molossians to expel their king again. Pyrrhus, now seventeen years of age, joined Demetrius, who had married his sister Deidamia. In the battle of Ipsus (301 B.C.), which terminated so unhappily for Demetrius and his father, Pyrrhus gave the first proofs of his impetuous courage. After the battle he went over from Asia to Greece, and exerted himself to save the remains of the forces of Demetrius; and when Ptolemæus, king of Egypt, made peace with him, Pyrrhus went as a hostage to Alexandria. Here he soon won the affections and the esteem of Berenice, the king's favourite wife, who gave him her daughter Antigone, by her first husband Philip, in marriage, and seems to have prevailed upon Ptolemæus to provide her new son-in-law with a fleet and money, and to send him back to his kingdom. Pyrrhus, on his arrival, reconciled himself with Neoptolemus, whom the Molossians, during his absence, had raised to the throne, and agreed to share the government with him. Neoptolemus was of a savage and cruel temper; and he soon conceived such a jealousy and hatred of his colleague, that he even attempted the life of Pyrrhus, who, to secure himself, put Neoptolemus to death, 295 B.C. (Plut., *Pyrrh.*, 5.) From this time Velleius Paterculus (i. 14) dates the commencement of the reign of Pyrrhus. Soon after this event, Alexander, the younger son of Cassander, who had been expelled from Macedonia by his brother Antipater, sought the aid of Pyrrhus, which was granted on condition that Alexander should give up Tymphaea and Parauaea (Niebuhr, *Hist. of Rome*, iii., p. 536), together with Ambracia, Acarnania, and Amphilochia. Pyrrhus at the same time formed an alliance with the Ætolians, and was thus enabled to resist Demetrius, who, after having murdered Alexander, had become king of Macedonia (294 B.C.). Secret jealousy had long existed between Demetrius and Pyrrhus. After the death of Deidamia, Demetrius carried off Lanassa, the second wife of Pyrrhus, who brought to her new husband the island of Corcyra, which her father, Agathocles of Syracuse, had conquered. Upon *this open war broke out between the two kings.* Demetrius invaded Ætolia, where he made some conquests, but leaving Pantauchus behind with a considerable force, he directed his march against Pyrrhus, who at the same time was setting out to protect his allies. The two kings, having taken different roads, passed each other without being aware of it; and Pyrrhus entered Ætolia, while Demetrius ravaged Epirus. Pyrrhus met Pantauchus, and a great battle ensued. Pantauchus, who was by far the ablest general of Demetrius, challenged Pyrrhus to single combat, in which the Macedonian, after receiving two severe wounds, was conquered, but not killed, being snatched away by his friends. The Epirotæ, encouraged by the news of the victory which their heroic king had gained, slaughtered many of the Macedonians, made five thousand prisoners, and chased the rest out of their country.

Pyrrhus now invaded Macedonia, where he penetrated as far as Edessa, and was joyfully received by many Macedonians, who joined his army. Lysimachus at the same time made an attack on Macedonia from Thrace. The mild conduct of Pyrrhus during this expedition induced nearly the whole of the Macedonian army to desert Demetrius, and to salute Pyrrhus as king of Macedonia (287 B.C.). Demetrius fled into Asia, where he was defeated by the son of Lysimachus, and surrendered himself prisoner to Seleucus.

Lysimachus now claimed to share the conquest; and Pyrrhus, who did not think it safe to enter into a new contest with the aged general of Alexander, consented to divide Macedonia between himself and Lysimachus. But this division only gave rise to fresh disputes. Lysimachus soon began to feel that Pyrrhus was an obstacle to his ambition. (Plut., *Pyrrh.*, 12.) The consequence was, that a few years after the division of Macedonia, when Demetrius was defeated in Syria, Lysimachus, having now no other enemy to fear, attacked Pyrrhus in his portion of Macedonia. The Macedonians, perhaps bearing a grudge against Pyrrhus for having consented to the division of their country, were easily persuaded to abandon the king of Epirus, who, without offering any resistance, withdrew his forces from the kingdom of Macedonia about 283 B.C. (Niebuhr, *Hist. of Rome*, iii., note, 813.)

Pyrrhus now enjoyed a few years of peace and happiness; but in 281 B.C. he was requested by the Tarentines to give them his assistance against the Romans. The Tarentines declared that they merely wanted a skilful general, that a sufficient number of soldiers would be raised in Italian Greece, as the Lucanians, Messapians, the Samnites, and they themselves, would furnish an army of 20,000 horse and 350,000 foot. These promises, and the hope of adding Italy and Sicily to his dominions, excited among the Epirotæ, no less than in Pyrrhus himself, so great a desire to enter this new field of action, that neither the wise remarks of the eloquent Cineas, nor the unfavourable season of the year, could prevent him from immediately setting out. Cineas was sent first with 3000 soldiers, and the king followed in Tarentine vessels of transport with an army of 3000 horse, 2000 foot, 2000 bowmen, 500 slingers, and 20 elephants. (Plut., *Pyrrh.*, 15.) His son Ptolemæus, by Antigone, then fifteen years of age, was left behind as guardian of the kingdom. (Justin., xviii. 1.) When the transports had reached the open sea, a tremendous storm arose. The king himself reached the Italian coast; but many of the ships were wrecked, and others effected their landing with great difficulty. Only a few horsemen escaped, and 2000 foot and two elephants were lost. With the remnant of his army Pyrrhus entered Tarentum. He soon discovered that the objects of these frivolous Greeks could not be attained, unless he assumed dictatorial power. He therefore shut up all their places of amusement, compelled all the men capable of bearing arms to serve as soldiers, and the younger to submit to regular military training in the gymnasia. The effeminate Greeks, who had not expected this, left their city in great numbers. The troops which had been promised by their allies did not arrive: the Lucanians and Samnites however were prevented from joining Pyrrhus by the Roman consuls. When the consul Lævinus entered Lucania with a numerous army, Pyrrhus provided for the security of Tarentum, and went out to meet the enemy. As he however wished to defer a decisive battle until the arrival of his Greek allies, he offered to act as mediator between the Greeks and Romans; but the haughty answer of Lævinus put a stop to all negotiation, and Pyrrhus pitched his camp on the north bank of the small river Siris, in the plain between Pandosia and Heraclea. The Romans, who were encamped on the south bank, were anxious to offer battle. The consul sent his horse across the river to attack the enemy's rear; but Pyrrhus discovered the movement, and, leading his own cavalry against them, the battle commenced. The king displayed the greatest activity, and was always in the midst of danger. His brilliant armour rendering him too conspicuous, he exchanged it for that of his friend Megacles, who, being taken for the king, was slain by a Roman. His armour was carried to Lævinus, who thought that the king himself had fallen. The battle lasted the whole day, and the Romans advanced and retreated seven times. The elephants were of great advantage to the Greeks; for as soon as the Roman cavalry perceived the huge animals advancing and opening the way for the Thessalian horse that formed part of the army of Pyrrhus, they fled back across the river. The infantry was involved in their flight, and the whole of the Roman army would perhaps have been destroyed, had not one elephant, growing faint from his wounds, stopped the pursuit. The remnants of the Roman army thus escaped in the darkness of the night, and the victors took possession of their camp. Pyrrhus, on the next day, visited the field of battle, buried the bodies of the slain enemies, amounting to 7000, as well as those of his own soldiers, and proposed to the Roman captives to serve in his army. They all refused; and Pyrrhus honoured their fidelity by sending 200 of them back to Rome. (Niebuhr, *Hist. of Rome*, iii., p. 559; Justin., xviii. 1.) Pyrrhus purchased this success with the flower of his own army, and he said that another such victory would compel him to return to Epirus.

The field of battle on the river Siris has latterly become a subject of great interest. In the year 1820 two bronzes of the most exquisite workmanship were found not far from the river, and near the site of the old town of Grumentum (now Saponara in the province of Basilicata), and within the enclosure of a ruin which has perhaps been a small temple. These bronzes, called the Bronzes of Siris, which were originally gilt, are each a little more than seven English inches in length. On each of them is represented in very high relief a hero fighting with an Amazon. They are now in the British Museum, and may at first sight be recognised as fragments of a magnificent cuirass. The character and the beautiful style of the work render it certain that they belonged to the school, or at least to the period, of Lysippus. They were in all probability brought over to the spot where they were found, by some one in the army of Pyrrhus, and may perhaps have formed part of the armour of the king himself or of one of his generals, though there is no evidence to prove this supposition. (Bröndsted, *The Bronzes of Siris*, an archæological essay, London, 1836.)

After the battle on the Siris, Pyrrhus advanced to within 300 stadia of Rome, and was joined by the Lucanians and Samnites. The Romans, undaunted by their defeat, and deserted by many of their allies, raised new troops and determined to try their strength again. It was not the intention of Pyrrhus to conquer or destroy Rome, but to conclude an honourable peace, and accordingly he sent his friend Cineas to Rome to negotiate while he assembled his Italian allies. The conditions which he proposed were, according to the most probable account of Appian (iii. 10, 1), that peace should be concluded with himself and the Tarentines, that all Italian Greeks should be free, and that all conquests which the Romans had made in Lucania, Samnium, Daunia, and Bruttium, should be given up. At the same time he offered to deliver all the Roman captives without ransom. The senate of Rome hesitated, until Appius Claudius, the blind, threw all his influence into the scale, and persuaded his fellow-citizens to send Cineas out of the city and to break off all negotiations. Pyrrhus, seeing that there was no hope of peace with the Romans, advanced with his army as far as Anagnia, and seems even to have taken possession of Præneste. (Flor., i. 18, 24; Eutrop., ii. 7.) He had ravaged all the country through which he had passed, and his soldiers, laden with booty, began to show great want of discipline. The Romans had now concluded a peace with the Etruscans; and the season of the year was too advanced to begin a new campaign: these circumstances combined to induce Pyrrhus to lead his troops back to Campania, where he found Lævinus with a numerous army. But neither of the two parties was anxious for battle, and Pyrrhus took up his winter-quarters at Tarentum. During the winter the Romans sent an embassy headed by C. Fabricius to negotiate for an exchange of prisoners. Pyrrhus refused the proposal, unless peace was concluded on the terms proposed by Cineas; but in order to show his esteem for the enemy, he allowed the prisoners to go to Rome for the purpose of celebrating the Saturnalia, on condition that if their fellow-citizens should not be willing to conclude peace, they should return after the festival. The senate would not hear of peace, and, after the festival was over, they sent the captives back to Pyrrhus. (Appian, iii. 10, 5; comp. Niebuhr, *Hist. of Rome*, iii., p. 586, &c.)

In 279 B.C., Pyrrhus began his new campaign, and in the neighbourhood of Asculum in Apulia he met the Roman consuls P. Sulpicius and P. Decius. The king compelled the Romans to come forward into the open field by sending his elephants with a division of light-armed troops to attack their flank. The Romans endeavoured in vain to break through the phalanx; Pyrrhus was irresistible, and the elephants dispersed and routed the Roman horse. The Romans, after having lost 6000 men, took refuge in their camp; Pyrrhus lost 3500 of his soldiers, and among them the flower of his army (Plut., *Pyrrh.*, 21; comp. Niebuhr's *Hist. of Rome*, iii., p. 589, &c.), and although he had gained the day, he retreated to Tarentum. He is said to have exclaimed, 'One more such battle, and we are lost.'

The Bronzes of Siris, drawn from the originals in the British Museum.

He had discovered how little he could rely on the discipline of his Italian allies; to draw reinforcements from Epirus was impracticable, as an insurrection had broken out among the Molossians (Appian, iii. 11, 1), while the northern part of Epirus was threatened with an invasion of the Gauls. The Romans, on the other hand, who seemed to gain new strength after every defeat, had formed a close defensive alliance with Carthage (Polyb., iii. 25), which immediately sent out a fleet to co-operate with the Romans against Pyrrhus. The Romans however declined this aid, and Mago, the Carthaginian admiral, sailed to Pyrrhus, who had already directed his attention to Sicily, to sound his intentions. In the meanwhile however an occurrence is said to have taken place which afforded to the Romans as well as to Pyrrhus a favourable opportunity to put a stop to hostilities. In the year 278 B.C., when the consuls C Fabricius and Q. Papus had taken the field against Pyrrhus, a traitor belonging to the retinue of the king proposed to the consuls to destroy his master by poison. The Romans are said to have apprised the king of his danger (Niebuhr, *Hist. of Rome*, iii., p. 594, &c.), who, as a reward for their honesty, ordered Cineas to lead all the Roman prisoners back, without ransom, and laden with rich presents. Cineas was also authorised to make peace. The generosity of the king rendered the Roman senate more flexible than before, and although peace was refused unless the king would consent to quit Italy, yet the Tarentine prisoners and other allies of Pyrrhus were sent back, and a truce was concluded (Appian, iii. 12, 1), which enabled the king to cross over to Sicily with his army. The garrison in Tarentum and other places remained, and Alexander, son of Pyrrhus by Lanassa, was entrusted with the command at Locri. (Justin, xviii. 2.) Pyrrhus had been invited by the inhabitants of Agrigentum, Syracuse, and Leontini to lend his aid against some Sicilian tyrants and the Carthaginians, who had already taken possession of many towns in the island and were besieging Syracuse by land and by sea. Pyrrhus willingly complied with their wish, hoping that it would not be difficult to make himself master of the island, and thus more effectually to support his Italian allies.

After having spent two years and four months in Italy (Diodor., *Fragm.*, lib. xxii. 11), Pyrrhus landed with his army in Sicily. The Carthaginians withdrew their forces from Syracuse. Almost all the towns of Sicily threw open their gates to him; Eryx was besieged and soon reduced. The Mamertines, who held several towns in subjugation and exacted heavy tributes, were likewise subdued. The Carthaginians were at last driven from Sicily, with the exception of Lilybæum, where they fortified themselves, and were besieged by Pyrrhus. They were willing to give up the whole island, with the exception of this last stronghold, and even offered money if Pyrrhus would conclude peace on these terms. But Pyrrhus, urged by the chief Sicilians, whom nothing short of an entire evacuation of their island by the Carthaginians would satisfy, declared that he could enter into no negotiation unless they would withdraw all their forces from Sicily. (Diodor., *Fragm.*, lib. xxii., 14.) After a long and useless siege of Lilybæum, the king determined to man his fleet and make a landing on the coast of Africa. But his severity in compelling the Sicilian Greeks to man his vessels, and his mistrust of them, roused their discontent. The two leading men among them, Thynion and Sosistratus, incurred his suspicions, and one of them was put to death. This act suddenly called forth the hatred of the Sicilians, and some of them threw themselves again under the protection of the Carthaginians, while others called the Mamertines to their assistance. While this dangerous spirit was spreading in Sicily, Pyrrhus received information that the Tarentines and Samnites were no longer able to hold out against the Romans, and he gladly seized this opportunity of quitting the island, and hastened to Italy.

In his passage through the straits he was attacked by the Carthaginian fleet, and lost seventy of his ships, and he reached the coast of Italy with only twelve which were in sailing condition (276 B.C.). On arriving at Locri, he found himself in great difficulties, not being able to pay his soldiers. To satisfy their wants, he took the sacred treasures from the temple of Proserpine. When the treasures were embarked, a storm arose, in which some of the ships were lost; the others, laden with the treasures, were cast back on the coast of Locri.

Pyrrhus, whose mind seems to have lost its former energy and self-possession, fancied that he had incurred the anger of the goddess, and not only restored all the treasures to the temple, but endeavoured to atone for his crime by offering rich sacrifices; and as the signs appeared to be inauspicious, he put to death all those who had advised or consented to the sacrilegious act. (Appian, iii. 12.) On his march towards Tarentum, his army was attacked and harassed from the mountainous districts by numbers of Mamertines, who had come over from Sicily before him. Pyrrhus here again evinced his usual courage. A huge barbarian challenged the king to single combat, and Pyrrhus, though already wounded, hurried forward, and cut the man in two with his sword. This proof of his undaunted spirit put an end to the attacks of the barbarians, and he reached Tarentum in safety.

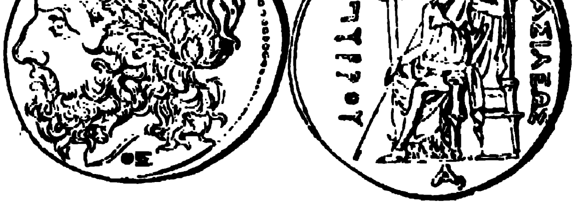
Having here reinforced himself, he set out against the Romans, and pitched his camp in Samnium. The Romans sent out two consular armies, under Manius Curius, who marched into Samnium to meet Pyrrhus, and L. Cornelius Lentulus, who took up his position in Lucania (275 B.C.). The Samnites sent a contingent to his army, but it was small, as they bore some ill-will towards him. Pyrrhus sent a part of his army to Lucania, to prevent Lentulus joining his colleague. Curius had taken his position, and fortified himself on the hills near Beneventum, wishing to avoid battle until the arrival of Lentulus. It was the intention of Pyrrhus to attack the Roman camp by surprise before daybreak, but in order to reach the summit of the hill above the Roman camp, he had to lead his army a long and fatiguing way through the forests, and when he descended upon the Roman camp it was broad day-light. Curius turned round to attack the enemy, who after some resistance took to flight. This success emboldened Curius to direct his attack against the main army of the king in the plain. The elephants, frightened and infuriated by burning arrows, which the Romans showered on them, put the king's army into disorder, and were thus the cause of a complete defeat. The king's camp fell into the hands of the Romans. Two elephants were killed and eight taken; Pyrrhus himself, with only a few horsemen, escaped to Tarentum. He nevertheless did not despair, but sent letters to several kings, requesting them to supply him with men and money. (Paus., i. 13.) Antiochus promised to comply with his wish, but Antigonus refused. A report of advancing auxiliaries for the king kept the Romans at a distance, and enabled Pyrrhus to set sail for Epirus with the greater part of his troops. Milo however was left behind, with the command of the garrison at Tarentum, and his son Helenus.

On arriving in his kingdom, Pyrrhus found himself unable to provide for the wants of his small band, and after some Galatians had joined him, he invaded Macedonia in order to gain by plunder the means of maintaining his troops. Fortune once more favoured him, and he soon made himself master of nearly the whole of Macedonia. Thinking that a more glorious field was now opening to him, he gave up all intention of returning to Italy, and recalled Milo and his son Helenus. Antigonus, who had assembled an army of Galatian mercenaries, was defeated by a son of Pyrrhus, and fled from his kingdom.

Before Pyrrhus had firmly established himself in Macedonia, he was invited by Cleonymus, a worthless Spartan, to assist him against the king Areus. Pyrrhus advanced to Sparta with a numerous army, ravaging and plundering the neighbourhood. Though king Areus was absent, Pyrrhus met with a most determined resistance from the women as well as the men of Sparta, and his son Ptolemæus, who had made his way into the city, was nearly killed. Pyrrhus himself had a severe contest at the gates of the city, which was interrupted by night, and recommenced the next morning. He succeeded in forcing his way into the city, but the united exertions of the Spartan men and women drove him from it. At the same time king Areus arrived from Crete, and auxiliaries from Corinth were on their march to Sparta, and Pyrrhus therefore gave up the contest, and contented himself with ravaging the country. He intended to take up his winter-quarters in Laconia, but another opportunity for action offered itself. Argos was distracted by two factions; one was headed by Aristeas, who called Pyrrhus to his assistance, while Aristippus, his adversary, sought the protection of Antigonus. The king immediately marched towards Argos. On his road he was attacked by Areus, who lay in ambush and cut off the rear of his army. Pyrrhus left Ptolemæus behind to oppose Areus, and proceeded on his road. His son fell in a fierce battle, and Pyrrhus, turning back to avenge his death, slew with his own hand Eualcus, who had killed his son.

In the meanwhile Antigonus had occupied the hills near Nauplia, and Pyrrhus pitched his camp in the plain. The Argives, dreading the issue of a battle, promised that their city should not be hostile to either party, if they would not attack it. Antigonus consented, and gave his son as a hostage. Pyrrhus likewise promised to keep peace, but gave no pledge of his intentions. In the ensuing night Aristeas opened one of the gates to him, through which Pyrrhus with his Galatians entered, and took possession of the market-place. The Argives, roused from their sleep by the noise, sent to Antigonus, who immediately advanced with his forces. Areus at the same time arrived with a select body of Cretans and Spartans. The darkness of the night and the narrowness of the streets produced the greatest confusion among the combatants. At daybreak, Pyrrhus, discovering that all the fortified parts of the city were occupied by armed troops, wished to get out of Argos. While he was making this attempt, assisted by one of his sons, he was killed by an old woman, who, seeing her son fighting with the king, threw a tile upon his head from the roof of her house.

Pyrrhus died in the year 273 B.C. (Niebuhr, *Hist. of Rome*, iii., note, 928.) All the antients agree that he was one of the greatest generals; and Hannibal himself declared him to be the first. But great as he was in battle, he did not know how to make the best use of a victory. His ambition was rather to acquire than to preserve, and he generally soon lost the advantages which he had gained. He was grateful towards his subjects, and owned that he was indebted to them for all that he possessed. As a man, he stands pre-eminent among the kings of his time; for while they were surrounded by worthless flatterers, Pyrrhus had friends such as few kings have ever possessed. In his family he was an affectionate father and husband. A change seems to have taken place in his character from the time when he embarked for Sicily, and no blame can be attached to his conduct previous to that event. The death of Neoptolemus was a mere act of self-defence, but his conduct towards Sparta has left a stain upon his character. Pyrrhus also attempted to distinguish himself as an author (Cic., *Ad Famil.*, ix. 25; Plut., *Pyrrh.*, 21); but we have no means of judging of his merits in this respect, as no part of his work remains. The Life of Pyrrhus by Plutarch is one of the most exquisite specimens of biography.



Coin of Pyrrhus.

British Museum. Actual size. Silver. The head is probably that of Jupiter.

PY'RULA. [SIPHONOSTOMATA.]

PYRUS, the Latin word for 'pear-tree,' is a name now given by botanists to a considerable number of Rosaceous plants, whose collective character is to bear a fruit resembling in all essential circumstances that of the apple or pear; that is to say, inferior, fleshy, with a cartilaginous lining to the cells, which are simple, and contain from 1 to 2 seeds in each. But the similarity in the fruit is by no means accompanied by an equal degree of resemblance in the foliage and manner of growth of the species, some of them being trees with the aspect of the apple and pear, while others have pinnated leaves which have caused them to be vulgarly regarded as species of ash, and many are dwarfish shrubs, with quite a peculiar appearance.

In consequence of such differences the genus is divided into several sections, the most important of which are,—1, the Apples and Pears, with oval simple leaves, and the stature of trees; 2, the Beam-trees, with coarsely toothed leaves white with down beneath; 3, the Mountain Ashes, with pinnated or pinnatifid leaves; and 4, the Dwarf Crabs, with oval simple leaves, and the stature of bushes. Upon each of these it is necessary to state something.

To the section of apples and pears belong not only the well-known fruits so called [APPLE; PEAR] and all their many varieties, but also several species whose fruit is less valuable. On Mount Sinai grows a species called *P. Sinaica*, whose fruit is hard, gritty, and austere, and whose leaves are grey with down; in Germany a similar kind, the *P. nivalis*, is by no means uncommon, with a considerable resemblance to the last; Siberia and Persia produce another, called *P. salicifolia*, with very narrow hoary leaves; and in the former country are found the Siberian crab, *P. prunifolia*, and the berry-fruited crab, *P. baccata*, whose fruit is too small for ordinary consumption, but is often seen in the form of a sweetmeat. Besides these, the Chinese crab, *P. spectabilis*, and also *P. coronaria*, are cultivated for their flowers.

The Beam-trees derive their name from the use that has been made of their tough wood for beams, axletrees, and similar purposes, where great strength is required. It is especially for the cogs in the wheels of machinery that it was used, till superseded by iron. The common Beam-tree is *Pyrus Aria*, and inhabits the rocks of the west and north of England, where it forms an ornamental object with its dark-green foliage shifting to silvery-white when disturbed by the wind. To this section may be referred without inconvenience the true Service, *Pyrus domestica*, a tree now not uncommon in England, but originally from the south of Europe, with a large pyramidal head, coarsely serrated leaves, and a green austere fruit, which however blets like the medlar, when it becomes tolerably eatable, though very indigestible. Its wood is very compact, and is said to be the hardest and heaviest of any indigenous in Europe.

The mountain ash, *P. aucuparia*, is a well-known ornamental tree, with a graceful habit, fragrant clusters of white flowers, and loose bunches of scarlet berries. It is found wild all over Europe and in the north of Asia; a variety occurs with yellow berries. In North America it is represented by a nearly allied species, *P. Americana*, with large copper-coloured berries, and a third kind, *P. microcarpa*, with very small scarlet fruit. The mountain ash is the rowen-tree of the Scotch, whose boughs were supposed to be a protection against witchcraft. It forms a hardy and good stock on which to graft the pear-tree, when it is desired to dwarf that species.

The dwarf crabs are small bushes with dense clusters of white flowers succeeded by black or red fruit very like that of the mountain ash. All are North American, except a Swiss species, *P. chamæmespilus*, and are scarcely cultivated except as objects of curiosity.

(See Loudon's *Arboretum Britannicum*, vol. ii., p. 917 &c., for very copious information concerning this genus.)

PYTHA'GORAS, the son of Mnesarchus, was born about the year 570 B.C., in the island of Samos. By his mother's side he was connected with the most distinguished families of the island; his father, according to most accounts, was not of pure Greek blood, but either a Phœnician or a Tyrrhenian of Lemnos or Imbros. The history of Pythagoras is obscured and disfigured by a cloud of fables, through which we are unable to discover anything beyond the most general outline of the chief events of his life and his character. He is said to have been a disciple of Pherecydes of Syros; and if we could give credit to the various other traditions respecting his masters, he would appear to have been connected with almost all the philosophers of the age, from Thales and Anaximander down to the obscure Creophilus and Hermodamas. (Porphyr., *De Vit. Pythag.*, 2; Diog. Laert., viii 2.) But the information which he derived from his countrymen did not satisfy his inquisitive mind, and, like many other illustrious Greeks, he travelled into various countries. He first visited Egypt, where he was introduced to King Amasis by letters from Polycrates. From Egypt he went to Asia, where he is said to have made himself acquainted with the science of the Chaldæans and the Magi: some traditions even state that he visited India and the Gymnosophists. But though these traditions may have some historical foundation, thus much is certain, that his philosophical system was not derived from any foreign source, or even materially influenced by anything that he saw and learned in the countries which he visited. All that he derived from foreign countries cannot have been more than general impressions which their political and religious institutions made upon him, and which may in some measure have decided the natural bias of his mind. His whole philosophy bears the impress of genuine Greek growth, and there is scarcely anything in it which may not be traced to some native source. On his return from his travels, he seems to have conceived the plan which he afterwards endeavoured to realise; but finding that the tyranny which Polycrates had established in his native island would be an insurmountable obstacle to his views, he set out in search of a new home. After having travelled through several parts of Greece, partly to strengthen himself in his opinions, for which purpose he perhaps visited Crete and Sparta; partly to form useful connections, as at Olympia and Delphi; partly also to sound the minds of the people, and to discover how far they might be disposed to carry his designs into effect, he finally settled at Croton in Southern Italy. The aristocratical government and the state of parties in this city seem to have been particularly favourable to the realization of his political and philosophical schemes, and the place was therefore certainly not chosen by the philosopher without due consideration. The fame of his wisdom and of his travels had probably gone before him to the Italian Greeks. The aristocratical party at Croton, who were in possession of all the political power, had excited discontent among the people; and though still strong enough to maintain their position against the commonalty, they must have hailed the arrival of a stranger, who, being supposed to be endowed with supernatural powers, commanded the veneration of the multitude, and was willing to serve the oligarchs on condition that they would allow him some degree of influence in their political measures.

From the moment of his favourable reception by the senate of Croton, whose object seems to have been, to use him as an instrument for their own ends, a new æra in the life of Pythagoras commences; but before we proceed to consider the manner in which he endeavoured to put his theory into practice, we shall attempt to give a brief outline of his philosophical principles, which will serve to throw some light upon his institution, which we shall describe hereafter. The philosophic school of which Pythagoras was the founder, is sometimes called the Italian or the Doric school. The latter name seems to have been given to it, not so much because it was peculiar to the Doric race, or because its object was to establish the ideal of a Dorian state (Müller, *Dor.*, iii. 9, § 15), but because it was neither connected with the Ionian nor the Attic school; though, on the other hand, it must be admitted that the institutions which Pythagoras established at Croton, in many respects bore great analogy to the Doric institutions which he had seen in Crete and Sparta. It is the more difficult to give a clear idea of the philosophy of Pythagoras, as it is almost certain that he himself never committed it to writing, and that it has been disfigured by the fantastic dreams and chimæras of later Pythagoreans. In modern times great light has been thrown upon the subject by the careful examination and analysis of the fragments of Philolaus by Boeckh (*Philolaus des Pythagoreers Lehren nebst den Bruchstücken seines Werkes*, Berlin, 1819). Philolaus of Tarentum, a disciple of Pythagoras himself, was in all probability the first Pythagorean who wrote an exposition of the system of his master, and his fragments must therefore be considered as the most genuine source of information. The results at which Boeckh arrived, are on the whole the same as those which Ritter, in his 'Geschichte der Pythagorischen Philosophie' (Hamb., 1826) subsequently reached, though by a different mode of inquiry. Pythagoras considered numbers as the essence and the principle of all things, and attributed to them a real and distinct existence, so that in his view they were the elements out of which the universe was constructed. How he conceived this process, has never yet been satisfactorily explained; but he was probably led to the supposition by observing that the periodical occurrences in nature, and almost all institutions and religious regulations and observances in Greece, were founded on numerical relations. Pythagoras thus traced the various forms and phenomena of the world to numbers as their basis and essence. But he did not stop here: he ascended still further to the principles of numbers themselves: these principles he conceived in the form of contrasting pairs, such as straight and curve, limited and unlimited, one and many, odd and even, and others. (Aristot., *Metaph.*, i. 5.) Further, he traced these contrasts to one first principle and element, the unit (μονάς), which included both the even and the odd, &c., and thus the even was odd. This unit he considered as the formal as well as material basis of all things, and as identical with the one supreme being, or God. The decad and tetractys or the quadrate, are likewise described as perfect numbers and first principles; the triad was called the number of the whole, because it had a beginning, middle, and end. Pythagoras conceived the vital process of the world as a process of breathing, and the first principle was therefore likewise a breathing being, which inhaled the infinite atmosphere of the world (*ἄπειρον πνεῦμα*), and thus partook of its infinity and became capable of developing itself into a multiplicity of numbers or things. The perfect development of the original unit is represented in our actual world, which consists of small and large wholes in the greatest variety. The special principle of every single whole or organization is again a unit, or a point separating itself from the rest; and as it is a living germ, it develops itself by breathing the *ἄπειρον πνεῦμα* into a distinct body of peculiar form and properties. Every abstract idea was thus in reality a number, and physical objects were symbolical representations of numbers. In the world which had thus arisen out of a union between the even and odd, &c., the Pythagoreans distinguished five elements,—fire, air, water, earth, and the so-called fifth element (*τὸ πέμπτον στοιχεῖον*), which was probably the æther. In the centre of the universe they placed the central fire (*ἑστία τοῦ παντός*, as it were, the altar of the universe), the principle of life in the world. The central fire is surrounded by the earth, the moon, the sun, the five planets, and the firmament, all of which were either gods themselves or inhabited by gods inferior to the supreme God who ruled the whole. The universe was divided, according to Philolaus, into three regions (*διάκοσμοι*). The first was the sublunary region, between the earth and the moon, the scene of change and passing events, where beings come into existence and perish again; it was called the heaven (*οὐρανός*). The second region was the region from the moon upwards to the firmament, and bore the name of kosmos (*κόσμος*). The third, or the firmament itself, called Olympus, was probably, in accordance with the national and traditional belief of the Greeks, considered as the abode of the gods. The heavenly bodies, together with the gods themselves, were conceived as performing a choral dance round the central fire, whence the music or the harmony of the spheres.

Advancing from the consideration of the universe to man, the Pythagoreans represented the souls of men as light particles of the universal soul diffused through the whole world (Cic., *De Nat. Deor.*, i. 11); the souls of the gods were considered as proceeding directly from the central fire, which was on this account designated 'mother of the gods,' while the souls of men proceeded from the sun, which was a mere reflex of the central fire. The soul of man was divided into three parts, *νοῦς*, *φρένες*, and *θυμός*: the two former were considered as the rational half of the soul, and had their seat in the brain; the last, or *θυμός*, was the animal half, and its seat was in the heart. (Diog. Laert., viii. 19, 30; Plut., *De Plac. Phil.*, iv. 5.)

The doctrine of the transmigration of souls does not seem to have originated among the antient Greeks, for they describe the souls of the departed as dwelling in the lower world, from which there was generally no return. Pythagoras may have derived it from some of the mysteries, for he is said to have been initiated in all the existing mysteries both of Greece and other countries. He and his followers considered the transmigration of souls as a kind of purifying process. The souls, previous to their entering into human bodies, floated in the air, from whence they were inhaled by the process of breathing at the moment of birth. At the moment of death, they descended into the lower world, where they were probably supposed to dwell a certain number of years, after which they again rose into the upper world, and floated in the air, until they entered into new bodies. When by this process their purification had become complete, the souls were raised to higher regions, where they continued to exist, and to enjoy the presence and company of the gods.

The Pythagoreans, according to Aristotle (*Eth. Magn.*, i. 1), were the first who determined anything in moral philosophy. Their ethics are of the loftiest and most spiritual description. Virtue was with them a harmony, unity, and an endeavour to resemble the deity. The whole life of man should be an attempt to represent on earth the beauty and harmony displayed in the order of the universe. The mind should have the body and the passions under perfect control; the gods should be worshipped by simple purifications, offerings, and, above all, by sincerity and purity of the heart. Besides the works of Ritter and Boeckh referred to above, compare Ritter's 'History of Antient Philosophy,' i., p. 327, 420, Engl. transl.

After this brief sketch of the philosophy of Pythagoras, we shall proceed to consider the manner in which he endeavoured to apply it, or at least its ethical part, to the affairs of ordinary life, which will at the same time show the one-sidedness of a view which might be derived from a statement of Cicero and Diogenes Laertius. Both of these authors say that Pythagoras was the first Greek who assumed the title of philosopher, and that he compared his vocation to that of a spectator at the public games. The definition implied in this comparison is only applicable to a small portion of the philosophy of Pythagoras, for he manifestly did not consider mere contemplation as the sole and highest object of man, but it was his doctrine that by action as well as by thought the individual as well as the state should represent in themselves an image of the order and harmony by which the world was sustained and regulated.

The precise objects of his institutions at Croton are not quite clear, though we cannot suppose that they were either exclusively philosophical, religious, or political. The perfect state of society, such as he conceived it, depended as much on sound religious and philosophical, as on political principles. It was not his intention to bring about his reforms at once by force or by the introduction of a new code of laws, but by gradually diffusing his enlightened ideas. He seems never to have filled any public office at Croton, and perhaps he may have declined such places in order that he might not be checked in his designs by any of the existing institutions, which he could only have overthrown by force. His scheme, though in its objects similar to some of modern times, was not near so visionary and as extravagant; for that it was by no means impossible to give a new form to society is clear from the reforms wrought by Lycurgus at Sparta, of Zaleucus at Locri, and of Charondas at Catana. Pythagoras established at Croton a society or an order, of which he himself was the head, and which was to be the centre from whence his reforms were to emanate. It consisted of three hundred young men, selected from the most distinguished families of Croton and other Italian cities. The society was, as a modern historian expresses it, 'at once a philosophical school, a religious brotherhood, and a political association.' The earnestness and honesty with which Pythagoras went to work are apparent from the fact that he admitted none but the ablest men into his society, and that he bestowed the most anxious care on the cultivation of their minds and hearts, in order to render them alive to the highest objects that can engage the human mind, and to make them clearly understand the place which they occupied in the world. The proceedings of the society were transacted in the greatest secrecy, but perhaps more on account of the religious doctrines there inculcated than on account of either philosophical or political principles. Religion indeed seems to have been the foundation of the society, and that his religious principles greatly differed from those generally received is clear from the tenour of his system, and it is expressly stated that he censured Homer and Hesiod for their profane descriptions of the gods. (Diog. Laert., viii. 19.) Outwardly however he showed great respect for the objects of the popular worship—a prudence which, together with his dignified and priestly appearance, was well calculated to win the affections and the admiration of the people, while the purer doctrines which he imparted to his disciples secured their most perfect submission. He instituted among his disciples a secret worship, or mysteries, which are sometimes called Pythagorean orgies, and the science of numbers, geometry, and music; and even medicine and gymnastics, including dancing, were closely connected with the sacred rites. Women seem also to have been admitted, if not into the society, at least to some of the lessons of the philosopher. (Diog. Laert., viii. 21.)

As to the political character of the institution, from which we must derive our conclusions respecting his political views in general, it is expressly stated that it was aristocratical, but in the original sense of the term, in which it means the government of the wisest and the best. His object was to establish a rational supremacy of minds enlightened by philosophy and purified by religion; and as such a state of things did not exist in Greece, we can scarcely say that he preferred any one form of government to another for its intrinsic merits, but only in as far as he thought the one a more suitable basis for his own institutions than another. That an aristocracy probably in this point of view appeared to him preferable, is apparent from the fact that he is said to have thrown his influence into the scale in order to restore this form of government in some Italian cities, where it had given way to tyranny or democracy. The three hundred members of the society were the model of an aristocratical senate, such as he would perhaps have wished to establish in every republic. We have no ground for believing that they possessed any legal authority at Croton, or superseded the old senate of the Thousand, as Niebuhr seems to think (*Hist. of Rome*, i., p. 160), for the Three Hundred included many who were not even citizens of Croton.

Those who wished to become members of the society underwent an examination by Pythagoras himself, who is said to have been skilful in judging of persons by their physiognomy. (Gellius, i. 9.) Those whom he thought fit to be received were then submitted to a period of regular probation and discipline. For a time, at least for two years, they were forbidden to speak. During this first stage of their noviciate they bore the name of Acoustici (hearers). During the second period they were allowed to ask questions, and to make objections to what they heard, as well as to write about what they had learnt during the first period. They were now called Mathematici, or scholars, for their instruction was not confined to what we call mathematics, but included music and gymnastics, in short everything which could be learnt. In the third stage, when they received the name Physici, they were admitted to the last secrets in religion as well as in philosophy and politics. Another division of his disciples which is frequently mentioned, was that of Esoteric and Exoteric, and it can scarcely be doubted that the former of these names had reference to the three hundred, from whom no kind of knowledge which their master could impart was kept secret, while the name Exoteric was either applied to those who were passing through the first stages of their noviciate, or, what is more probable, to a much greater number of persons, who were not initiated into all the secrets which the master had to unfold, and perhaps received no instruction of a purely religious nature. The real character of some other divisions mentioned by the antients—for instance, Pythagorici, Pythagorei, and Pythagoristae, or Sebastici, Politici, and Mathematici—is matter of great difficulty, though it is not improbable that they may have been expressive of gradations similar to those described above. All candidates on entering upon their noviciate had to exchange their former mode of life for one which was regulated even to the most minute details by Pythagoras himself. Their diet seems to have been a subject of his especial attention, though the extant accounts of the restrictions under which he is said to have placed them are contradictory and incredible. The doctrine of the transmigration of souls may however have led him to enjoin abstinence from animal food. Many of these regulations respecting the diet and the whole mode of life of his disciples had probably a symbolical meaning, and were intended to impress upon their minds certain philosophical or religious principles. In its external arrangements the society of Pythagoras presents some analogy to the institutions which he had seen in Crete and Sparta. The members lived and took their meals together, and the union and attachment among them are said to have been so strong as to excite the jealousy of their relations. Conscientiousness and uprightness in all the affairs of life were points on which the philosopher laid great stress. (Iambl., *De Vit. Pyth.*, 144.)

The overwhelming influence which Pythagoras and his order had gradually acquired in Croton and other Italian towns where branch institutions of that at Croton seem to have been established, at first induced the aristocratical party of Croton to avail themselves of his services (Valer. Max., viii. 15, Ext. 1), but at the same time could not fail in the end to excite their jealousy. If on the other hand we consider that his interference in the affairs of the government must at all times have been viewed with dissatisfaction by the popular party, we see at once the weak basis on which his institution rested, and one great shock was sufficient to overthrow it. This shock arose out of a contest between the popular and aristocratical parties in the neighbouring town of Sybaris. Several exiles belonging to the latter party had taken refuge at Croton, and when the Sybarites required them to be surrendered, Pythagoras and his associates prevailed on the senate to reject the demand. A war broke out, which ended in the total destruction of Sybaris, 510 B.C. The senate of Croton and the Pythagoreans seem to have been elated by this victory, and refused to share the spoil and the conquered land with the people (Iambl., *De Vit. Pyth.*, 255), and it may have been about this time that the Pythagoreans, with overweening confidence in their own strength and that of the aristocracy, made the attempt to abolish the popular assembly. Such proceedings however, instead of intimidating the people, roused their indignation. A tumult broke out, in which the house of Milo, where the Pythagoreans were assembled, was burnt: many of them perished in the flames, and the rest saved their lives only by going into exile. Pythagoras himself seems to have been absent from Croton during this insurrection, and is supposed to have died a short time after at Metapontum (about 504 B.C.). Similar insurrections soon followed in several other towns of Italy, where branches of the Pythagorean society had been established. Some Pythagoreans, such as Philolaus, fled to Greece, where they taught their doctrines and had considerable influence on the philosophy of Plato. The Pythagorean system was revived at a later period, and in the second century of our æra it appeared mixed up with the doctrines of the New Platonists. (Krische, *De Societatis à Pythagora in urbe Crotoniatarum conditae Scopo Politico*, Göttingen, 1831.)

Various discoveries in mathematics, music, and astronomy are ascribed to Pythagoras, but it would be difficult to establish the truth of these traditions by historical evidence. We have not thought it worth while to repeat the monstrous mass of fables and miracles which are interwoven in the biographies of Diogenes Laertius, Porphyrius, and Iamblichus. It may safely be said that the history of no antient sage is so obscured by fables as that of Pythagoras. He himself may, by his own priestly appearance and conduct, and by the secret proceedings of his society, have given rise to them, and may even have encouraged the general opinion that he was endowed with supernatural powers; but on the whole these are mere symptoms of the mighty impression which he made on his contemporaries, as well as on subsequent ages, for such an impression is the most fruitful source of marvellous stories of every description.

PY'THEAS, a celebrated navigator, was a native of the Greek colony of Massilia. He flourished, according to some authors (Bougainville, *Mémoires de l'Acad. des Inscript.*, tom. xix.), before Aristotle; but according to others, in the reign of Ptolemæus Philadelphus. Respecting the circumstances of his life nothing is known. Polybius, who disbelieved the accounts of his voyages, calls him a poor man, who could not possibly have undertaken such long journeys by land and voyages by sea. (Polyb., *Reliq.*, lib. xxxiv., 5.) From the same source we learn that he is said to have made two voyages. In the first he sailed round the western coast of Europe and through the English Channel as far as Thulo, which is generally supposed to be Iceland. This voyage he described in a work called a 'Description of the Ocean' (*περὶ 'Ωκεάνου*), where, among other things, he stated that he had landed in Britain and travelled through it, as far as it was accessible, and that its circumference amounted to upwards of 40,000 stadia. Respecting the land of Thule, he said that there was neither land, nor sea, nor air, but something composed of all of them, and in substance like that of the mollusca, in which the earth, the sea, and the whole universe were suspended. This substance, which he had seen himself, was, as he had been told, a connecting link of the universe, and it was impossible to penetrate into it either by land or by sea. (Strabo, ii. 5, p. 181, ed. Tauchnitz.) This fabulous account of Thule may be easily explained; and that he advanced at least as far as Iceland seems to be clear from his statement that during the summer solstice in Thule the sun never disappeared from the horizon. (Plin., *Hist. Nat.*, ii. 75.) He places Thule six days' sail from Britain. Some time after his return, he set out on a second voyage, in which he sailed along the whole western coast of Europe, from Cadiz into the Baltic as far as a river which he called Tanais, on the banks of which amber was found. (Plin., *Hist. Nat.*, xxxvii. 2.) What river the Tanais may have been is uncertain. D'Anville and Gosselin denied the second voyage of Pytheas altogether, though the words of Polybius admit of no doubt that there was in his time a report of such a voyage, probably founded on the assertion of Pytheas himself. It is said to have been described in a work called Periodus or Periplus.

The motives for his undertaking such long voyages are entirely unknown, but it is generally supposed that the Massilians, a flourishing commercial republic, wishing to extend their mercantile connections, sent him out to explore the unknown regions of the north. In this case however the epithet *poor*, which Polybius gives to Pytheas, would be ill applied, as his personal poverty would have been no obstacle to his entering upon such bold enterprises. Pytheas also distinguished himself as a mathematician and an astronomer, and among other discoveries ascribed to him, he is said to have been the first who determined the meridian altitude of the sun at the summer solstice at Massilia, by means of a gnomon. (Hipparchus ap. Strab., ii. 5, p. 182, ed. Tauchnitz.)

His merits have been differently judged of by the antients, for while Eratosthenes and others adopted his statements in preference to those of others, Polybius (*Reliq.*, lib. xxxiv., 10), and especially Strabo (in many passages of lib. i. and ii.), treat him with the utmost contempt, though the latter does not despise his accounts of the manners and productions of the countries which he visited. Modern geographers however have discovered reasons for judging more favourably of Pytheas, and have ascertained that he is right in several points for which he is censured by Strabo.

The few fragments of his works were collected and edited in 1824, by Andr. Arw. Arwedson, Upsala. Compare Brückner, 'Historia Reipublicæ Massiliensium,' Göttingen, 1826, p. 64, &c.; 'Pytheas de Marseille et la Géographie de son Temps; ouvrage publié par Jos. Straszewicz, orné de trois Cartes géographiques,' Paris, 1836 (this work has been translated into German by S. F. W. Hoffmann, Leipzig, 1838). See also Ukert, *Bemerkungen über Pytheas, Geographie der Griechen und Römer.*

PY'THIA. [DELPHI.]

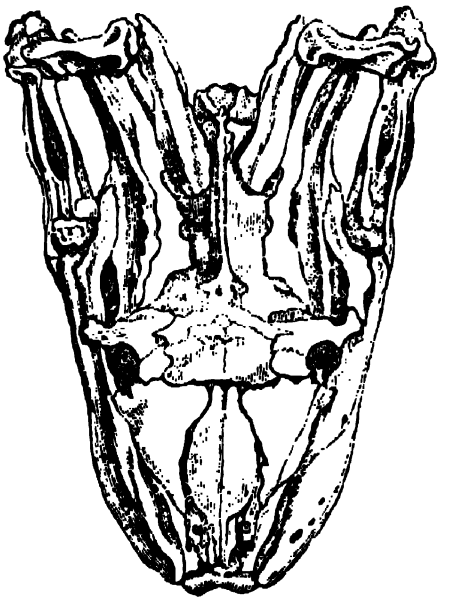
PYTHIAN GAMES (*Pythia*, or *Pythici Ludi*), one of the four great national festivals of the Greeks, were celebrated near Delphi, in honour of Apollo, originally every ninth year, and afterwards every fifth year, in the autumn of the third year of each Olympiad, in the second or third month of the year, according to Clinton. Corsini and others, followed by Boeckh, place them in the spring, in the month Munychion, the tenth of the year. Their origin is assigned by some to Amphictyon, the son of Deucalion, or to the Amphictyonic council; by others to Agamemnon; by Pausanias to Diomed; by Strabo to the Delphians, after the Crissæan war; but most commonly to Apollo, after he had vanquished the serpent Python. (Ovid, *Met.*, i. 445.) There is an account that the gods and heroes contended in the first celebration of these games, when Castor conquered in the horse-race, Pollux in boxing, Calais in the foot-race, Zetes in fighting in armour, Peleus in throwing the quoit, Telamon in wrestling, and Hercules in the pancratium. But the fact seems to be, as stated by Pausanias (x. 7, 2) and Strabo (ix., p. 421), that the contest was originally in music: the songs (*πυθικοὶ νόμοι*) were in honour of Apollo, celebrating his victory over the Python; and the instrument used was the lyre. In the third year of the 48th Olympiad (B.C. 586), at the close of the Cirrhæan war, the Amphictyons added a contest on the flute, which was afterwards discontinued, as the music of the flute was considered too mournful for a joyous festival. In the same year the Amphictyons also introduced athletic contests and races (but not with four-horsed chariots), the foot-race being confined to boys; and the games, according to Strabo, were then for the first time called *Pythia*; at all events the subsequent Pythia are computed from this year by Pausanias and the Parian marble, though the scholiast on Pindar, and Eusebius, date them from the second celebration, in Ol. 49, 3: Boeckh and Clinton prefer the former date. Chariot-races were added in the time of Cleisthenes, the tyrant of Sicyon. The prize in the Pythian games was originally of silver or gold, or something else of intrinsic value; but afterwards a crown of laurel, or (according to Ovid, *Met.*, i. 449-50) at first, of the bay-oak or beech-tree (*æsculus*), for which the laurel was afterwards substituted. The ceremonies observed at these games, in common with the three other great festivals, are described under OLYMPIAN GAMES.

(Pausanias, x. 7; Strabo, ix., p. 421; Potter's *Archæologia Græca*, vol. i., c. 23; Wachsmuth, *Hellenische Alterthumsk.*, i. 110; ii. 379; Clinton, *Fasti Hellen.*, i., p. 228; ii., p. 195; iii., p. 296, 612.)

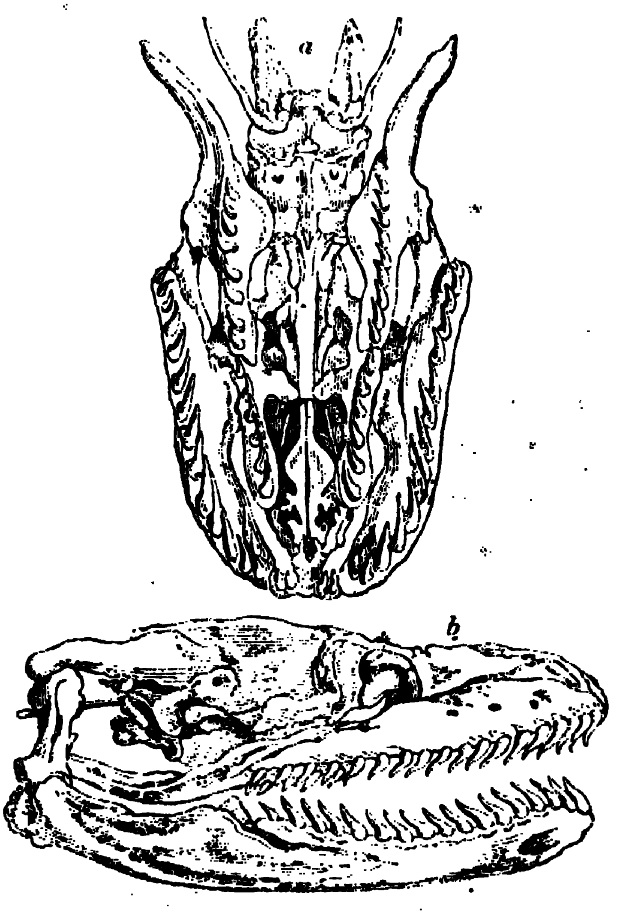
PYTHON, M. Daudin's name for the great constricting serpents of the Old World.

In the article *Boa* will be found much relating to *Python*: the organization of both is so similar, that a repetition becomes needless. Like the *Boæ*, the *Pythons* have processes or hooks near the anus, and narrow ventral plates, and indeed the latter can hardly be said to differ from the former except in the double plates beneath the tail. Their head has plates on the end of the muzzle, and there are fossets on their lips.

The powerful dental machinery by which a firm hold is gained as a fulcrum for the constriction; and the adaptation of the bones of the head to the dilatation necessary for swallowing the disproportioned prey, are shown in the following cuts.



Head of the great Python of Java, seen from above.



Head of the same.
a, upper part of the head, seen from below; *b*, the skull, seen in profile.

In the Museum of the Royal College of Surgeons the preparation, No. 282 D (*Physiological series*), is a portion of the vertebral column, with the ribs attached, of a *Python Tigris*. The ribs are articulated to the transverse processes of the vertebræ by shallow ginglymoid joints, which admit of their being moved forwards and backwards on an axis passing through the joints. The ligaments, independent of the articular capsule, are so disposed as to limit the motions of the ribs to these directions: they are two in number,—one situated below the joint, which passes from the head of the rib to the transverse process, and thence is continued to the capsule of the intervertebral articulation; the other strengthens the upper part of the joint, and connects the neck of the rib to the transverse process. (*Cat. Mus. Coll. Chir.*) This illustrates the structure for creeping noticed in the article BOA.

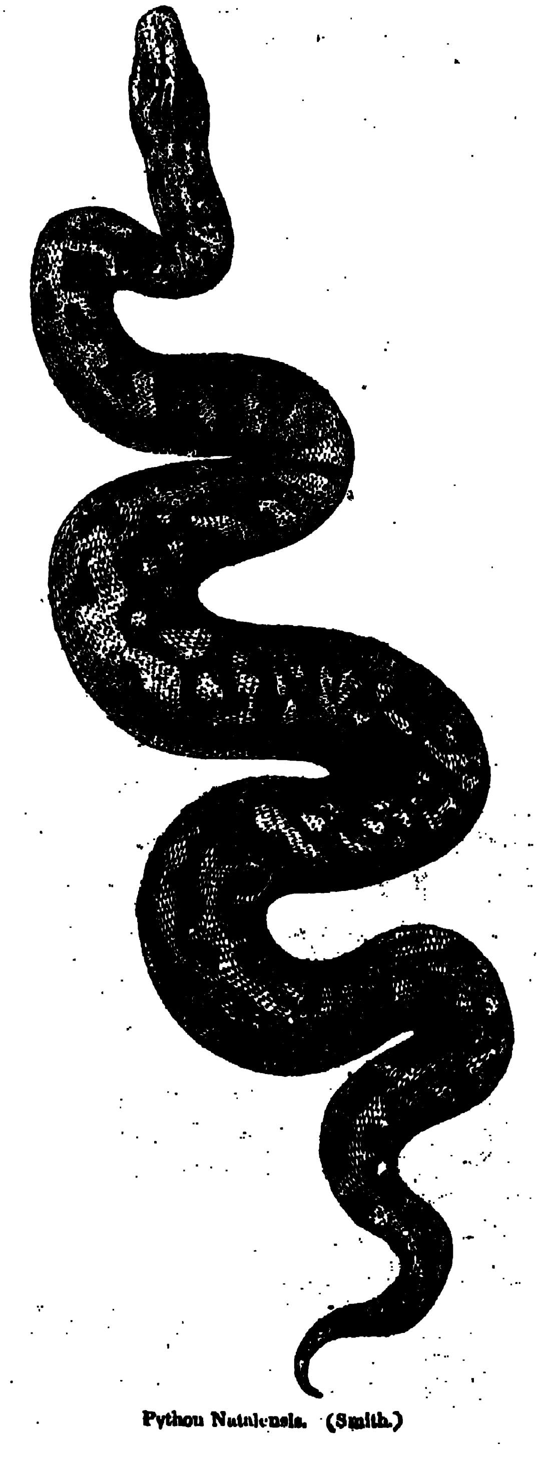
No. 608 A of the same series is the stomach, with part of the œsophagus and intestine injected and inverted, of a large African Snake (Python). The œsophagus, as in all the Ophidian reptiles, is very capacious, smooth internally, and thin in its coats. The commencement of the stomach may be detected by the more vascular and rugous character of its lining membrane. The larger wrinkles are longitudinal, the interspaces reticulate. The stomach gradually diminishes in size, and there is a constriction, like a pylorus, about one inch and a half from the intestine. A narrow canal of uniform diameter, analogous to that in the shark, conducts to the intestine, which suddenly becomes wider, and is beset internally with small flattened scale-like processes. (*Mus. Cat. Coll. Chir.*)

With reference to the observations in the article BOA, relating to the mode of its taking its prey, the gradual deglutition of the victim, and the breathing of the serpent during the operation, No. 1093 A of the same series becomes a very interesting preparation. This exhibits the lungs of a *Python Tigris*. They have been minutely injected, and are laid open to show the extent of the vascular respiratory portion, which is nearly the same in both, but the right lung is principally prolonged to form the reservoir. A part of the trachea, the two pulmonary arteries, and single pulmonary vein, are also preserved in this beautiful preparation by Mr. Owen. (*Cat. Mus. Coll. Chir.*)

The size to which the *Pythons* grow is fully equal to that attained by the *Boa*, if it does not exceed it. Thus the *Ular-Sawa*, or Great Python of the Sunda Isles, is said to increase till it is more than thirty feet in length, and stout in proportion. The powers of such a gigantic reptile must be enormous, and it is said that the serpent is able to manage a buffalo. Nor are there wanting horrible instances of man himself having fallen a prey to these monsters, in modern times. The story goes that a Malay prow was anchored for the night under the island of Celebes. One of the crew had gone on shore to search for betel-nut, and is supposed to have fallen asleep upon the beach from weariness on his return. In the dead of the night his companions on board were roused by dreadful screams: they immediately went ashore, but they came too late, the cries had ceased, and the wretched man had breathed his last in the folds of an enormous serpent, which they killed. They cut off the head of the snake and carried it, together with the lifeless body of their comrade, to the vessel. The right wrist of the corpse bore the marks of the serpent's teeth, and the disfigured body showed that the man had been crushed by the constriction of the reptile round the head, neck, breast, and thigh. The picture by Daniell, representing a man seized by one of these monsters, will be familiar to many of our readers.

Dr. Andrew Smith, in his valuable *Illustrations of South Africa*, now in course of publication under the authority of the Lords Commissioners of the Treasury, gives a very beau-

Python Tigris.

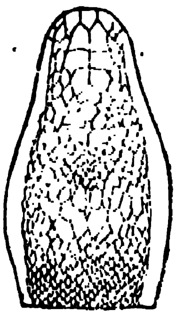


Python Natalensis. (Smith.)

tiful figure of *Python Natalensis;* and he states that this snake, or at least one resembling it in size, was formerly an inhabitant of the districts now within the Cape colony, and that the traditions of the older Hottentots abound with instances of its miraculous powers. At present, he says, it is not to be found within hundreds of miles of the boundaries of the colony, and few specimens have been obtained nearer than Port Natal. He informs us that it occasionally attains a very large size, and, according to the natives, individuals have been seen whose circumference was equal to that of the body of a stout man: Dr. Smith himself saw a skin which measured twenty-five feet, though a portion of the tail part[illegible]as deficient. 'It feeds,' continues the Dr., 'upon quadrupeds, and for some days after swallowing food, it remains in a torpid state, and may then be easily destroyed. The South Africans however seldom avail themselves of ridding themselves of a reptile they view with horror, as they believe that it has a certain influence over their destinies; and affirm that no person has ever been known to maltreat it without, sooner or later, paying for his audacity.'

The following remarks by the same author are well worthy the attention of those who are interested in the natural history of serpents and their geographical distribution.

'Owing to the difficulty of discriminating between certain species of *Python,* we are not prepared to maintain this reptile to be distinct from the Indian species (*Python bivittatus,* Schlegel). The characters which have been assumed as indicative of specific differences do not appear to us to have been of sufficient value; the modifications to which they are liable in different specimens, of whose specific identity no doubt can exist, show that some other characters must be discovered before certainty can be attained. The Indian species is doubtless an inhabitant of Africa, and there are several specimens of it both from India and Western Africa, in the museum at Fort Pitt, Chatham, which are precisely similar. Between these however and *Python Natalensis* there are several well-marked differences. The scales of *Python Natalensis* are proportionally smaller than in the individuals above mentioned; their form is also different. The labial *fossæ* are more numerous in young specimens from Western Africa and India, than in those of a similar age from South Africa; in the latter they are two upon each side, in the others, four or five; the plates on the head, also, are differently shaped and differently disposed. The pattern of the markings, when viewed in detail, is also distinctly different, though there is a sort of general resemblance. Persons who have opportunities of examining species of *Python* would do well to ascertain if the labial *fossæ* vary in number in different individuals of the same species and of the same size; also whether their number diminishes as age advances.'



Head of Python Natalensi

PYXACANTHA of the Antients. [LYCIUM.]

PYXIS NAUTICA (the Mariner's Compass), a southern constellation of Lacaille, placed in Argo. Its principal stars are as follows:—

Character.	No. in Catalogue of		Magnitude.
	(Piazzi.) Lacaille. C.	Astron. Society	
ε	(7)	1115	6
θ	(63)	1138	5
λ	(75)	1142	5½
η	(133)	1053	6
ζ	(140)	1059	6
β	(145)	1061	5
α	(162)	1070	4½
γ	(193)	1085	6
δ	(220)	1095	6
	(265)	1112	5½
	800 C	1084	6

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Q.

Q is a superfluous letter of the alphabet, having the same sound as *k*, though limited to words where a *u* follows. This letter furnishes evidence that the alphabetical characters were originally of syllabic power. Thus the Hebrew koph and the Greek koppa appear to have been used only in those words where the sound of *o* follows, as in Cos, Corinth, and Syracosii, &c. Indeed the name of the letter implies as much. The Greek alphabet probably stopped at one period, like the Hebrew, at *τ*, so as to have no *u*. On the other hand, the Etruscan alphabet had a *u*, but no *o*. Hence in Italy, the *q*, which, by position in the alphabet, corresponds to the Greek koppa, was limited to words where a *u* followed. In the same way the kaph of the Hebrew and kappa of the Greek were probably at first limited to those words where an *a* follows, as we know was the case in Latin; and as the modern name of the letter, *ka*, denotes, for it would otherwise have been called *ke* or *ek*. This view becomes more complete if it be called to mind that the name of χ connects it with the vowel *i*; and that the *η* or Ƞ of the Greek alphabet was originally a guttural aspirate, sounded perhaps as χη, and thus was adopted to denote either a guttural consonant or a long *e*. For the various forms of the symbol *q* see Alphabet, and for the changes to which the letter is liable see C and K.

QUA BIRD. [Nycticorax, vol. xvi., p. 376.]

QUADI, an antient people of Germany, who inhabited the country north of the Danube, between that river, the mountains of Bohemia, and the river March. Towards the north they bordered on the Marcomanni, in connection with whom they are frequently mentioned by the Roman writers as allies. Tacitus (*German.*, 42) mentions the Quadi, the Marcomanni, and the Narisci as being in the foremost rank among the German nations towards the borders of the Roman empire, the Danube forming the line of demarcation between the power of Rome and German independence. At a later period the Quadi joined a great confederacy of German nations against Rome, which occasioned much alarm to the empire, and which twice obliged the emperor Marcus Aurelius Antoninus to repair to Germany at the head of his legions. In the first of these wars, A.D. 174, Aurelius is said to have been unwarily drawn into an ambuscade of the Quadi, and to have been in great danger, when a violent shower of rain afforded a seasonable relief to the Roman army. [Aurelius, Marcus.] The second expedition of Aurelius against the Quadi and their allies the Marcomanni, Hermonduri, and Sarmatians, lasted three years, A.D. 178-80, with no decisive result. Capitolinus, in his 'Life of Aurelius,' merely says that if the emperor had lived another year he would have made those countries provinces of the empire. Aurelius however died at Vindobona, in the midst of his campaign, and the Quadi remained unsubdued. They are afterwards mentioned by Eutropius as having invaded Pannonia in the reign of Gallienus.

QUADRA, Island. [North-western Territory.]

QUADRANGLE and QUADRILATERAL (four-angled and four-sided). These terms are indiscriminately used to denote a figure with four sides in the same plane. [Parallelogram; Rectangle; Square; Trapezium; Rhombus.]

QUADRANT (*quadrans*) originally meant simply the fourth part, but is now in universal use for the fourth part of a circle.

QUADRANT. As an astronomical instrument, the quadrant has within a few years been so completely superseded by the entire circle, that it will not be worth while to describe particularly its construction or adjustments. Still so much of the very groundwork of modern astronomy depends on data furnished by the quadrant, that it cannot be properly passed over without some notice.

We have already said [Circle] that the earliest form of instrument for measuring celestial altitudes was also the first, viz the solstitial or meridian circle described by Ptolemy. After showing how the proportion which the arc between the tropics bears to the whole circumference was to be determined by this instrument, Ptolemy proceeds to say (*Almagest*, book i., chap. 10), 'We have made this sort of observation more conveniently by using, instead of circles, a stout quadrangular block of wood or stone, having one side plane and smooth. Upon this side we described a fourth part of a circle from a centre near one of the angles, and having drawn from the centre two radii including a right angle, we divided the circumference into ninety degrees with subdivisions. We then inserted two perfectly equal cylinders at the extremities of the vertical radius, so as to be exactly concentric with the centre and extreme point, and set the block vertical by a plumb-line passing over the cylinders, and also in the plane of the meridian by a north and south line described on the horizontal plane. We observed at noon the shadow of the central cylinder, having applied something to the divided arc to show the place more clearly, and, marking the middle point, we took the corresponding division of the quadrant as showing the elevation of the sun on the meridian.' It would seem that on the revival of learning, when Ptolemy was thought infallible, the quadrant came into use on this authority, to the exclusion of the circle. In the *Astronomiæ Instauratæ Mechanica* of Tycho Brahé, figures and descriptions will be found of quadrants and sextants of various forms and sizes We do not think justice is done at the present day to the merits of Tycho, who is better known as the perplexer of the Copernican hypothesis, than as the first great practical astronomer after Hipparchus. Among his numerous instruments Tycho had a large quadrant fixed on a wall, which he calls a *mural* quadrant, with which he observed meridian altitudes, noting the time of transit by a clock. There are several other quadrants figured and described, which revolve on a vertical axis, and some have a horizontal circle by which the azimuth was observed at the same time with the altitude. These may be considered as the precursors of the modern astronomical quadrant, and still more perfect altitude and azimuth instrument, just as his mural quadrant led to the mural arch of Flamstead, the mural quadrants of Bird and Ramsden, and finally to the mural circle of Troughton. The imperfection of his clocks (for the pendulum was not applied till nearly a century later) compelled Tycho to adopt an instrument which has long been out of use. This was his astronomical *sextant*, which was stronger, more convenient, and lighter than the quadrant. It was supported at the centre of gravity on a ball and hemispherical cup, and could consequently be easily placed in the plane passing through two stars, and so used for measuring their distance from each other. To verify the value of the arc, and to test the powers of his sextants and quadrants, the distances of a chain of stars near the equator were taken, and their declinations also observed, when it was found that the sum of the angles at the pole which resulted from observation was 360° very nearly. (Tycho Brahé, *Astronomiæ Instauratæ Progymnasmata*, pp. 138, 145.)

Hevelius has described his quadrants and sextants in the first volume of his *Machina Cœlestis*, a work which is not uncommon; the second volume, containing his observations, was burnt soon after it was printed, with the exception of a few copies, and is one of the scarcest and dearest astronomical books in existence. In the convenience of his instruments, and perhaps in the accuracy of their graduation, he surpassed Tycho, but he never could understand the advantage of telescopic over plain sights, though one of the best practical opticians and industrious star-gazers of his time. This unfortunate prejudice not only rendered the labour of his long life labour in vain, but embittered his latter years to a painful degree by involving him in a dispute with Hooke.

Picart, aided, as it is said, by Auzout, first applied telescopic sights to graduated instruments. In his measure of the earth, executed in 1669 and 1670, he used a quadrant for his terrestrial angles. This he has described, with figures, in a special work, printed at the Louvre, which became so rare that the *Académie Royale des Sciences* reprinted it in their Memoirs (vol. vii., part i., p. 133). The quadrant was of 38 inches radius, with one telescope fixed in the direction of one radius, and the other moveable about the centre; the arc of the instrument was divided by transversals, and the angle read off by the index of the moveable telescope was equal to the angle subtended at the quadrant by the objects bisected by the cross-wires of the two telescopes. The instrument could be fixed on its stand with the plane vertical when used for altitudes, and by an additional piece, a *genou*, was moveable into any other plane, when it was wanted for surveying. The whole turned on a vertical axis, like Tycho's azimuthal quadrants, but without an azimuth circle. Quadrants like Picart's continued to be made by the French artists and used by their astronomers (with some improvements, of course) up to the latter end of the last century, when they were superseded by the repeating circle of Borda. The verification of the arc and of the graduation was performed in Tycho's manner, only employing well defined objects in the horizon instead of stars.

For a fixed observatory Picart and Roëmer recommended a large quadrant permanently fixed, that is, a copy of Tycho's mural quadrant, with the changes which telescopic sights required. Lemmonier, in the preface to his *Histoire Céleste*, says that La Hire had one erected in the Royal Observatory of Paris, in 1683, and that it was described in the first edition of La Hire's tables. This description he repeats at page xlii. of his own work.

Flamstead made his earlier observations at Greenwich with a sector, the plan of which may be understood by conceiving one of Tycho's sextants with telescopes, instead of plain sights, to be mounted on a polar axis. (*Historia Cœlestis*, vol. iii., p. 103.) This instrument was designed for measuring the distances of stars from each other. But in pursuing his primary object, that of settling the places of the fixed stars with accuracy, Flamstead found that he required a *meridian* instrument. Some unlucky trials at constructing a quadrant were made by the person employed by the Royal Society, and Flamstead finally constructed, at his own expense, and by Abraham Sharp's hands, the mural arc with which he observed from 1689 to his death.[*] (See the description and figure, *Historia Cœlestis*, vol. iii., p. 108.) This differed from other mural arcs chiefly in this, that it contained 140° or 150°, so that all stars were observable with it, from Polaris, below the pole, to the south horizon. The arc was placed as nearly in the meridian as might be, and the errors in its plane detected by comparing the observed time of the sun's passage over the middle wire of the instrument, with the true time of his meridian passage, as deduced from corresponding altitudes with a quadrant. The pendulum clock, though as yet not a very perfect instrument, had by this time entirely done away with the necessity of observing the mutual distances of the stars.

When Halley succeeded Flamstead at Greenwich, the observatory appears to have been dismantled. Halley saw the great superiority of Roëmer's *transit* over every other instrument for ascertaining right ascensions, and accordingly introduced it; but he seems not to have perceived the advantages which Roëmer's *circulus meridionalis* possessed over any segment of a circle. In 1725 a mural quadrant was erected by Graham, which was superior to any previous instrument of this construction; it had however one grievous imperfection, the radii being of iron and the arc of brass, every variation of temperature altered the value of the total arc. In 1750, this quadrant, which was subsequently known by the name of the iron or north quadrant, was removed to the other side of the pier, and the celebrated quadrant by Bird set up in its place. Of Bird's method of dividing we have given some account in the article GRADUATION. His reputation, which was a good deal based on this quadrant, introduced similar instruments by himself or Ramsden into almost every observatory of note. Bird received 500*l*. from the commissioners of longitude for his *Method of dividing Astronomical Instruments*, and the work was published by their order in 1767. We are not aware that a more perfect quadrant than the Greenwich *brass* or *south* quadrant was ever constructed. It was with this instrument Bradley made his invaluable observations, which have been reduced with consummate skill by Bessel. (*Fundamenta Astronomiæ deducta ex Observationibus viri incomparabilis James Bradley, autore F. W. Bessel, Regiomonti*, 1818.) There is in this work a careful examination of the errors to which the two quadrants were liable.

When the portable quadrant was wanted for astronomical purposes, the plane was fixed vertically, and it is then usually called an astronomical quadrant. A great many instruments of this construction were made by Bird, Ramsden, and the Troughtons, in the latter half of the last century, and in careful hands a great deal of work may be done with such a quadrant.[*] Thus observations of the sun or stars at the same altitude on each side of the meridian will furnish an excellent determination of the time, and zenith distances of stars near the zenith in reversed positions of the instrument (the excess arc, as it is called, affords the means) will yield a good latitude. Observations of northern stars combined with southern stars at similar altitudes will give a very close approximation to the latitude when the true places of the stars are taken from a good catalogue. For the mode of adjusting and using the quadrant we must refer to the older books or encyclopædias which treat of astronomical instruments. The inferiority of the quadrant to the entire circle is such that there is no probability of its ever returning into fashion, and we believe there is not a single public observatory in which it is now in use. The single advantage of the quadrant is that the divisions are larger and consequently more easily read and subdivided than in a circle with the same telescope. But this trifling superiority is much more than compensated by the power of reading off the circle at several points and taking the mean. On the other hand it is impossible in the quadrant to secure the exactness of the total arc, or the concentricity of the centre of motion and the centre of the divisions, while the necessity of leaving some liberty of motion to the axis carrying the telescope allows of a little wandering of the centre-work, which is perpetually shifting its place. Thus it was found that in the celebrated Greenwich quadrant, though the error of division was probably not more than 1″, the uncertainty arising from other causes might easily be 3″ or even more. Again, in the mural quadrant it seems difficult so to support it as to resist the long continued effort of gravity in altering its form, without at the same time rendering it unstable. The Greenwich quadrant was found to have sensibly altered its shape, *i.e.* it had become flattened about 15″, and pulled out at the two extreme radii, which was shown by the errors in the places of stars observed by it when compared with their places by circular instruments, and also by an actual measurement of the several radii and chords. For more minute information the reader is referred to Lalande's *Astronomie*, § 2311, &c. 3me. edition; Vince's *Practical Astronomy*, chapter v.

QUADRANT. Hadley's quadrant is the name sometimes applied to the octant of reflexion which measures an angle of 90°. The principle is that of the SEXTANT.

QUADRANTAL, a name formerly given to spherical triangles, one side of which is a quadrant.

QUADRATIC, BIQUADRATIC (*quadratum*, a square), names given to algebraic expressions, the highest powers of which are the square, and the square of the square, or fourth power, of the letter with reference to which the expressions are considered. [THEORY OF EQUATIONS.]

QUADRATRIX, a name given to curves which may be made useful in the QUADRATURE of other curves. There is one known by the name of Dinostratus, the equation of which is—

$$y = (a-x)\sin\left(\frac{x}{a}\,90^\circ\right),$$

which curve being given, the ordinate, when $x = a$, determines the length of the circle whose radius is a, as follows. Make a rectangle on this ordinate equal to the square of the diameter, and the other side of that rectangle is the circumference of the circle.

The quadratrix of Tschirnhausen has for its equation—

$$y = a\sin\left(\frac{x}{a}\,90^\circ\right),$$

and this curve being given, and also the method of drawing a tangent to it, the circumference of a circle may be then found: Draw a tangent at the origin, and draw a right-angled triangle with a part of this tangent for the hypothenuse, and a part of the axis for a base: the other side is then the quadrant of a circle which has the base for a radius.

Various other modes might be found of making either of these curves square the circle; but the fact is, that the description of the curves themselves assumes the point which their use is to determine.

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[*] Among the *real* injuries which Flamstead received, we consid[illegible] translation of his preface into indifferent Latin one of the greatest, though committed with a friendly intention.

[*] A very perfect specimen of the astronomical quadrant is desc[illegible] Pearson's 'Astronomical Instruments,' vol, ii., p. 554.

QUADRATURE. By the quadrature of a curve is meant the finding of a square equal to the content enclosed by the curve; but as every rectilinear figure can be immediately converted into a square of equal magnitude, the object is gained as soon as any rectilinear figure is found of the same content as the curve. This is the geometrical quadrature of a curve. The arithmetical quadrature is the determination of the area enclosed by the curve in terms of a given square unit, as a square foot; and if this be done with any required amount of accuracy, the quadrature, thus done sufficiently for practical purposes, is spoken of as an absolute quadrature. The two following articles will in various places illustrate the preceding description of the meaning of the simple word.

QUADRATURE OF THE CIRCLE. The speculative part of this question might be passed over with a slight description of the means of finding a square equal to a given circle, or of expressing a circle by means of the square on its radius, if it were not that it is connected with one of those propensities, the love of the marvellous, which, carried to an undue extent, tend more than others to throw the mind off its balance, and destroy the comfort of the individual. When it is considered that there are still persons who spend their time, means, and energies in the attempt to overcome a difficulty of which they do not even know the character, it is worth while to enter a little more at length upon this celebrated question of the quadrature of the circle than its mathematical importance would seem to require.

It is a proposition not very difficult of proof, that if a right-angled triangle have the radius of a circle for its base, and a line equal to the circumference for its altitude, the triangle is equiareal with the circle. Hence the quadrature is reduced to the finding a line equal in length to the circumference, either geometrically or arithmetically: or to finding an answer to one or other of the following questions:—

Given a, the diameter of a circle in units of a given kind required a number or fraction π, such that a multiplied by π may be the number of those same units in the circumference. It is easily shown that this number π must be the same for all circles.

Given the diameter of a circle, required *geometrically* a method of drawing a straight line equal in length to the circumference.

Those who first proposed these questions, found their progress arrested by the insufficiency of their arithmetic and the limitations of their geometry. The former question has long been settled, and it has been shown that the ratio of the circumference to the diameter is Incommensurable. The latter question cannot be called finally settled, since there is no proof in which all agree that the geometrical quadrature is impossible, though there are considerations which render it in the highest degree unlikely, and there are also asserted proofs of the impossibility which some admit, and which make even those who do not absolutely admit them think their conclusion all but proved. But the mistake of those who produce pretended quadratures often lies in this, that they do not know what is meant by the word *geometrical.* They imagine that anything is geometrical which deals in notions about space, and deduces that which is not obvious from that which is. But geometry, in the technical sense, is that which results from the use of Euclid's postulates [Axiom], which permit nothing but the junction of two points by a straight line, the indefinite production of that joining line, and the description of a circle with a given centre, and the line joining that centre with another given point as a radius. These limitations make the whole difficulty; otherwise nothing would be more easy than to determine a circle by the Quadratrix, if that were allowed to be drawn, or to suppose a circle to roll on a straight line till the point which first touched the straight line touches it again, in which case the line rolled over is the length of the circumference. When therefore any one imagines, as is often the case, that he has found a method of squaring the circle, it generally happens that he only announces the not very new nor surprising fact, that a difficulty which exists under certain circumstances may be no difficulty at all under others. But in like manner as no one would be held likely to answer the question 'required the way of building a house without the use of iron,' who should first demand a hammer and nails, so the greater number of persons who attempt to square the circle must not be supposed to meet the geometrical difficulty, by assuming powers of which geometry expressly requires the use to be abandoned, until it can be shown to be given in allowing the simple postulates above mentioned.

Aristophanes introduces into his comedy of the 'Birds,' a geometer who is going to make a square circle; Plutarch asserts that Anaxagoras employed himself upon this problem in prison. Hippocrates of Chios actually found the way to make a rectilinear space equal to certain circular spaces, and is reported to have attempted the general problem. There is evidence enough that it acquired an early celebrity, and it may be doubted whether the researches of Euclid in incommensurables [Irrational Quantities] had not some reference to a supposition that the circle and its diameter might possibly be discovered to belong to a particular class of these quantities. Archimedes, in his book on the mensuration of the circle, is the first who made any approach even to a practical determination of the question; by inscribing and circumscribing a polygon of 96 sides in and about the circle, he demonstrates that the excess of the circumference over three times the diameter must be less than 10-70ths of the diameter, and greater than 10-71st parts. His result is perfectly correct, and even tolerably accurate. According to him a circle of 4970 feet diameter would have a circumference lying between 15,610 and 15,620 feet, the truth being that such a circle would have a circumference of 15,613¾ feet very nearly. This measure of Archimedes gives 3·14286 for the approximate value of π, the ratio of the circumference to the diameter; several of the Greeks are said to have made further approximation, but their results are not preserved.

Among the Hindus [Viga Ganita] are found the ratios of 3927 to 1250, and also that of the square root of 10 to 1. The first gives $\pi = 3·1416$ exactly, and is considerably more correct than that of Archimedes': the second gives 3·1623, and is much less exact. The date of the first result is not known; but all agree that the writings in which it is found are anterior to any European improvement on the measure of Archimedes. The ratio given by Ptolemy, in the Syntaxis, is 3·141552, not quite so correct as 3·1416, but so near to it that those who doubt of the antiquity of Hindu science will probably suppose the 3·1416 above mentioned to be a version of Ptolemy's measure.

This subject began to be reconsidered in the fifteenth century, in the middle of which were calculated the tables of Rheticus, the celebrated Copernican, from which the value of π might easily have been calculated to eight decimals, but it does not appear that this was done. Purbach used the ratio of 377 to 120, or 3·141667, not so exact as Ptolemy's. Regiomontanus slightly corrected the limits of Archimedes, but Peter Metius, father of Adrian (to whom it is often attributed), and of James (to whom the invention of the telescope has been given), made a decided improvement. He gives the ratio of 355 to 113, or 3·14159292, which is correct to the sixth decimal inclusive. Nothing more precise could be desired for practical purposes, insomuch that a circle of 113 in diameter may be reckoned as one of 355 in circumference, which, though a little too great, does not give the circumference wrongly by so much as one foot in 1900 miles. Metius lived in the latter half of the sixteenth century, as also did Vieta, who gave a still more accurate though not so elegant a measure. He was the first who exhibited a series of arithmetical operations, by which a mere calculator might carry on the process to any extent, and gave the following result: The circle whose diameter is ten thousand million of parts, has a circumference greater than 31,415,926,535 of those parts, and less than 31,415,926,537. Other approximations rapidly followed: Adrianus Romanus calculated the perimeter of an inscribed polygon of 1073741824 sides, by means of which he found for the ratio 3·141592653589793; but his contemporary Ludolph van Ceulen, by calculating the chords of successive arcs, each of which is the half of the preceding, found the perimeter of a polygon of 36893488147419103232 sides, and obtained 36 figures of the ratio 3·14159, &c., presently given to a still greater length. So far the method of calculating by means of inscribed polygons had received no material simplification. This was given by Snell, who found some propositions (afterwards demonstrated by Huyghens) which very much abridge the labour. He found a result as correct as that of Archimedes, by means of a simple hexagon; making the 96-sided polygon of Archimedes give seven decimals correctly, instead of three. He also calculated the ratio to 55 decimal places, and by means of a polygon of only 5242880 sides.

Huyghens introduced some new theorems of the same species as those of Snell.

The invention and cultivation of the differential calculus led to many new views and new methods, into which it is not our purpose to enter, as we intend the present article not for mathematicians, but for those who have just enough of the science to think it possible that the solution of the problem is reserved for them. The continued product of Wallis, the continued fraction of Brounker, the series of Mercator, Gregory, Newton, &c., were so many new algebraical expressions of a result which, one might imagine, would be considered as carried far enough by the arithmetician. Nevertheless the ratio was consecutively carried to 75 places by Abraham Sharp, to 100 by Machin, and to 128 places by De Lagny, and at the end of the last century to 140 places by Vega. And Baron Zach informed Montucla that he had seen a manuscript in the Radcliffe Library at Oxford, in which it was carried to 154 places.

Vega's result, which, as far as it goes, is confirmed by those of Machin and De Lagny, is as follows:—

3· 14159 26535 89793 23846 26433 83279 50288 41971 69399 37510
58209 74944 59230 78164 06286 20899 86280 34825 34211 70679
82148 08651 32823 06647 09384 46095 50582 26136

But the Oxford manuscript gives as the ending (according to Montucla)—

46095 50582 23172 53594 08128 4802

So far as these agree, there is no doubt of their correctness, so that the approximation has been carried to 135 decimals certain. There is only one use in this extent of accuracy, which far exceeds all that is necessary, namely, that the more rational class of solvers of the problem are steadied by it, and are prevented from presenting results which do not agree with the known truth.

The never-ending character of these numerals, so far as they were tried, led to an early suspicion that the ratio must be really incommensurable. This was actually proved by Lambert (*Mém. Acad. Berlin* for 1761), and the demonstration has been given in an abridged form by Legendre, in the notes to his work on geometry. This demonstration is perfectly complete, and leaves no manner of doubt on the subject. Those who persist in asserting that they can assign two numbers which are in the ratio of the circumference to the diameter, should first learn geometry and algebra enough to refute this proof, for they may depend upon it that no mathematician will lend them a moment's attention until this preliminary step has been taken. Buffon, and Panckouke, the editor of the 'Encyclopédie Méthodique,' have attempted to give metaphysical reasons for this incommensurability, apparently in order that the squarers of the circle might not have all the nonsense on their side of the question.

The *geometrical* quadrature, as above described, was attempted to be shown to be impossible by James Gregory, in 1668; and Montucla seems to admit the proof at last,* though he only said that it was *very like demonstration* in the first edition of his work on the history of this problem. The objections made by Huyghens to this proof, and the controversy which ensued, obliged the latter to admit that Gregory had succeeded in proving the impossibility of what is called the indefinite quadrature of the circle, by which is meant the finding of a method of squaring any given sector of the circle whatsoever. But since it is well known that there are curves, particular portions of which may be squared, this may happen in the case of the circle. Thus it might be possible to give a geometrical rule for squaring the whole circle, even though the rule would not apply to any given sector. The proposition which Gregory imagines himself to prove, is that no sector of a circle can have to the circumscribed polygon a ratio expressible by a finite number of algebraical terms. The consequence of this, if established, must be drawn as follows:—Since geometry allows the use of nothing but definite circles and straight lines, a straight line equal to the circle in length (which being found, the whole difficulty is overcome) must be ascertained, if at all, by a construction in which points are successively determined by the intersections of straight lines or circles, or a straight line and a circle. The most complicated construction in Euclid may, if we begin from the first principles, be reduced to the determination of a succession of points in this manner. Now, in the most complicated case, the intersection of two circles of given or found radii and centres, the points of intersection may be determined by formulæ derived from the roots of an equation not exceeding the fourth degree, the roots of which can be expressed in a finite form: th two ends of the line equal to the circle could therefore be assigned in a finite form, and hence the length itself. And the area of any polygon (whose arcs are obtained by continual bisection) described about a given circle could also be expressed in a finite form, from which (the area of the circle being expressible by means of its circumference) the ratio of the area to that of the circumscribed polygon would also be expressible. But if Gregory's proposition be true, this area cannot be expressed in a finite form; neither then can any construction allowable in geometry attain the circumference of a circle.

The indefinite quadrature was shown to be impossible by Newton (*Principia*, book i., lemma 28), in a manner which lies open to solid objections; we shall not therefore produce this proof. In fact, it seems as difficult to induce geometers to agree in any proof of the impossibility of the indefinite quadrature, as others to leave off trying their powers upon what geometers themselves have ceased to attempt.

Montucla has given a tolerable list of those who have signalised themselves by attempting this problem without the requisite preliminary of studying geometry; if preliminary that may be called, which would have made them give up the attempt. 'Only prove to me that it is impossible,' said some one, 'and I will set about it immediately,' and such seems to have been the general feeling of the quadrators, as Montucla calls them. They existed in crowds in the time of Archimedes; and the race is not yet extinct. One Bryso, a Greek, heads the list: he made the circle a mean proportional between the inscribed and circumscribed squares, which happens to be the content of the inscribed octagon. Next we have Cardinal Cusa, Orontius Fineus, and one Simon van Eyk (or Duchesne). At the time when the problem really was of practical importance, every quadrator raised up an opposing mathematician; and the quadrature was sometimes so ingenious, and so near the truth, that it could only be opposed by new approximations to the truth. Thus Cusa was met by Regiomontanus, Orontius by Buteo and Nonius, and Van Eyk by Peter Metius, who was compelled to discover the very close approximation we have given under his name by that of Archimedes being insufficient to expose Van Eyk. Such quadrators were of use, and if some of them would now arise, no one would object to fallacies so ingenious that new truths must be discovered to oppose them. The celebrated Joseph Scaliger, a mere tyro in geometry, tried his hand on this and other problems in 1592, and was met by Vieta, Adrianus Romanus, and Clavius. Longomontanus, the astronomer (refuted by Pell), J. B. Porta, and Hobbes (refuted by Wallis), are three names well known in other pursuits who must go down to posterity as having had distinguished success in false quadrature. The works of the last against geometry and geometers were the consequence of the mortification he felt at not having been admitted to have succeeded in his attempt. Before his time however, Gregory of St. Vincent, an acute mathematician (to whom is due the discovery of the connection between the hyperbolic area and logarithms), had made the most elaborate attempt which ever was published, in his work on the quadrature of the circle (Antwerp, 1647). Such a challenger raised up Des Cartes, Roberval, Huyghens, and Léotaud, who soon dispatched him.

As yet we have mentioned only mathematicians, or men of eminence in something: but we have also the Spaniard Falcon (1587), who dialogues with the circle in his preface: Gephirauder and Alphonso de Molina, who attribute their discovery to inspiration; the latter overturns Euclid, and found another who was willing to admit his discoveries and translate them into Latin. A merchant in Rochelle, De la Leu, not only found out the problem by inspiration, but showed that the conversion of Jews, Turks, and Pagans depended upon it. Montucla gives some account of several other visionaries, the chief of whom is one Cluver, who found that the problem depended upon another, namely, 'Construere mundum divinæ menti analogum,' which, if it be translateable, is, 'to make a world analogous to the divine mind.' He also mentions Richard White, an English Jesuit, who stands out among the solvers of the pro blom as the only one who ever was convinced of his error. The writer of this article once pointed out the example of White to another Roman Catholic clergyman, who had come from South America to England, to publish a quadrature of the circle. The party addressed seemed struck by the instance, and promised to study more geometry before he proceeded further; in a little while however he relapsed, and his work was advertised, and, we believe, published.

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* The following was the addition left by him, and printed by the editor of the second edition: 'Après avoir réfléchi encore plus attentivement sur les raisonnement de Gregory, il me paraît avoir eu raison d'en déduire l'impossibilité de la quadrature même définie du cercle.'

After the time of Newton, and the abundant means which were then introduced to complete the quadrature, if such a thing were possible, persons versed in mathematics seem to have dropped the attempt, and the reign of the quadrators by instinct commences. It is true that a serious diversion was made by the theory of gravitation, which drew off against itself many of those who should have been quadrators; but enough remained to furnish a tolerable list.

That of Montucla contains principally Frenchmen, though had the history of mathematics been written by an Englishman, he could have produced as great a number in this country. One Mathulon, in 1728, promised in print 1000 crowns to any one who should convict his solution of error, and was actually sentenced by the courts to pay the sum to the Hôtel Dieu at Lyon, to which charity Nicole, the exposer, made over his claim. One Sullamar (as Montucla spells it), an Englishman, solved the problem by means of the number of the beast, 666, in the year 1750; a M. de Causans, in 1753, found it by cutting a piece of turf, and deduced from it the doctrines of original sin and of the Trinity. He offered to bet three hundred thousand francs on the correctness of his process, and deposited ten thousand, which were claimed by several persons, and among others by a young lady, who brought an action for them: but the bet was declared void by the courts. Many more cases might be added; it is however enough to say that this problem is now never attempted (in print at least), except by those who are either altogether ignorant of mathematics, or add a most undue opinion of themselves to an acquaintance with only the elements. Since 1755, the Academy of Sciences has refused to examine any pretended solution; and the Royal Society in this country came to the same resolution a few years afterwards.

A few words may serve to prevent some one from making an attempt upon this enchanted castle, as it is supposed to be. When the difficulty first began to be noticed, the circle stood alone among curves; and so remarkable a distinction between this, the only curve then considered, and rectilinear figures, the only other figures then considered, could not but excite curiosity. Our position is now changed; not only does the now well recognised distinction of commensurable and incommensurable prevent the circle from presenting anything peculiar to itself, but the curve is only one among an infinitely great number, many of which have been investigated and their properties examined. Consequently, with reference to the present state of mathematics, the problem analogous to that of squaring the circle is, 'Given any curve whatsoever, to find its area.' Now if the ingenuity which is guided by the love of investigating hidden things, should desire a field for its exertions, let it leave that of the circle, which has been cropped until it will yield no more, and, first acquiring sufficient mathematical knowledge, let it spend its force upon some one of the many real difficulties which abound, both in the pure and mixed sciences: let it investigate the meaning of divergent series for example, in all their varieties, or endeavour to extend the theory of discontinuous expressions, or solve the equations of motion of the solar system by some other method than that of series. For one point that should strike the lover of the marvellous in the quadrature of the circle, there are hundreds in the above-named subjects which surprise the mathematician, however little he may possess that quality. Moreover, in like manner as the quadrature of the circle was at one time, in the hands of Wallis, Newton, &c., a road to results which, though they did not attain their end, yet answered many other purposes; so the efforts of the inquisitive on the actual difficulties of our own day may also end in the promotion of science of every kind, if begun in knowledge and directed by system. We owe the binomial theorem, now one of the most important results of algebra, indirectly to the learned attempts of Wallis upon the quadrature of the circle, at a time when such attempts were in season and we might reasonably hope for collateral successes something like those resulting from the labours of Wallis, if those (not a few) whose minds compel them to inquiry into the curious, would but furnish themselves with a guide before they set out on their travels.

QUADRATURES, METHOD OF. The method of quadratures derives its name from its earliest application, that of finding the areas of curves, which was always called their quadrature, as being the arithmetical process by which, when exact, squares equal to them might be found. And since the AREA of a curve can always be found when $\int y\,dx$ can be found, this term has also been applied to the determination of the definite values of integrals by approximation. Any integral [INTEGRATION] can be found approximately by a summation, the limit of which is the exact value: thus we could determine $\int y\,dx$ from $x = a$ to $x = a + h$ by dividing h into a large number, n, of equal parts, and actually summing

$$a.\frac{h}{n} + \left(a+\frac{h}{n}\right)\frac{h}{n} + \left(a+2\frac{h}{n}\right)\frac{h}{n} + \ldots + \left(a+n\frac{h}{n}\right)\frac{h}{n}.$$

but the special object of that which is called *the* method of quadratures is the perfection of this method of quadratures (which is either very inexact or very tedious), by subsequent corrections, which are most readily derived from such mathematical considerations of the error committed as are described in the article OPERATION. The theorem on which it is founded may be seen in p. 313 of the 'Differential Calculus,' in the 'Library of Useful Knowledge:' exhibited in the best form for practical use, it is as follows:—

Let $\int y\,dx$ be required to be found from $x = a$ to $x = a + h$: divide h into n equal parts, and let $A_0, A_1, A_2, \ldots A_n$ be the values of y corresponding to the following values of x, namely a, $a+\frac{h}{n}$, $a+2\frac{h}{n}$, ... $a+n\frac{h}{n}$ (or $a+h$). Compute

$$S = (A_0 + A_1 + A_2 + \ldots + A_n)\frac{h}{n}$$

And, writing down A_0, A_1, &c., as below, take their differences. [DIFFERENCE.]

$$\begin{array}{l} A_0 \quad A_1 \quad A_2 \quad A_3 \ldots\ldots\ldots A_{n-3} \quad A_{n-2} \quad A_{n-1} \quad A_n \\ \quad \Delta A_0\ \Delta A_1\ \Delta A_2 \ldots\ldots\ldots\ldots \Delta A_{n-3} \quad \Delta A_{n-2} \quad \Delta A_{n-1} \\ \qquad \Delta^2 A_0\ \Delta^2 A_1 \ldots\ldots\ldots \quad \ldots\ldots \Delta^2 A_{n-3} \quad \Delta^2 A_{n-2} \\ \qquad\quad \Delta^3 A_0 \qquad \ldots\ldots\ldots \qquad \Delta^3 A_{n-3} \end{array}$$

up to the fifth differences, which will be generally sufficient Then the value of $\int y\,dx$ from $x = a$ to $x = a + h$ is as follows, very nearly:—

$$S - \frac{1}{2}\frac{h}{n}(A_n + A_0) - \frac{1}{12}\frac{h}{n}(\Delta A_{n-1} - \Delta A_0) -$$
$$\frac{1}{24}\frac{h}{n}(\Delta^2 A_{n-2} + \Delta^2 A_0) - \frac{19}{720}\frac{h}{n}(\Delta^3 A_{n-3} - \Delta^3 A_0) -$$
$$\frac{3}{160}\frac{h}{n}(\Delta^4 A_{n-4} + \Delta^4 A_0) - \frac{863}{60480}\frac{h}{n}(\Delta^5 A_{n-5} - \Delta^5 A_0)$$

For example, let the integral required be $\int\frac{dx}{x}$ from $x = 9$ to $x = 13$ (we take purposely a case in which verification is easy). Here $a = 9$, $h = 4$, $y = 1 : x$. Divide the interval 4 into ten equal parts, so that $h : n = \cdot 4$. We have then 9, 9·4, 9·8, ... 12·6, 13, for the eleven values of x, and writing down their reciprocals, and taking their differences, we have

	A =	ΔA = − ·00	Δ²A = + ·000	Δ³A = − ·0000	Δ⁴A = + ·00000	Δ⁵A = − ·00000
0	·11111111	472813	38597	4541	685	122
1	10638298	434216	34056	3856	563	103
2	10204082	400160	30200	3293	460	076
3	09803922	369960	26907	2833	384	061
4	09433962	343053	24074	2449	323	054
5	09090909	318979	21625	2126	269	041
6	08771930	297354	19499	1857	228	
7	08474576	277855	17642	1629		
8	08196721	260213	16013			
9	07936508	244200				
10	07692308					

S 1·01354327 × ·4 = ·40541731

$$\begin{array}{rcl|lcl}
A_{10} + A_0 & = & \cdot 18803419 & \times \frac{1}{2} & \times \cdot 4 = & \cdot 03760684 \\
\Delta A_9 - \Delta A_0 & = & \cdot 00228613 & \times \frac{1}{12} & \times \cdot 4 = & \cdot 00007620 \\
\Delta^2 A_8 + \Delta^2 A_0 & = & \cdot 00054610 & \times \frac{1}{24} & \times \cdot 4 = & \cdot 00000910 \\
\Delta^3 A_7 - \Delta^3 A_0 & = & \cdot 00002912 & \times \frac{19}{720} & \times \cdot 4 = & \cdot 00000031 \\
\Delta^4 A_6 + \Delta^4 A_0 & = & \cdot 00000913 & \times \frac{3}{160} & \times \cdot 4 = & \cdot 00000007 \\
\end{array}$$

$$\begin{array}{r}
\overline{\cdot 03769252} \\
\cdot 40541731 \\
\end{array}$$

$$\text{Approx. value of} \int_9^{13} \frac{dx}{x} \quad = \quad \overline{\cdot 36772479}$$

This same result, found by common methods, is hyp. log 13 − hyp. log 9, or 2·56494936 − 2·19722458, or ·36772478: so that the preceding method is in this case more than correct to seven figures by use of four differences.

This method of quadratures is the mathematician's last resource when all others fail or are still longer. In most of the cases in which it is absolutely requisite, the calculation of the values of *y* is the most tedious part of the operation. When the limits are very different, it is generally requisite to divide their interval into several parts, and to make the integrations through the several parts separately. For an inverse process see SUMMATION.

QUA'DRIO, FRANCESCO SAVE'RIO, a learned Jesuit of the eighteenth century, a native of Valtellina, wrote an historical and descriptive work on his own country, which he dedicated to Pope Benedict XIV. 'Dissertazioni Critico-Storiche intorno alla Rezia di quà dalle Alpi oggi detta Valtellina,' 3 vols. 4to., Milan, 1755. It is the best account which we have of that secluded region. The author occasionally exhibits a want of critical fairness, as where he attempts to excuse the massacre of the Protestants which took place in 1620, and was attended by circumstances of great atrocity. But the principal work of Quadrio, and that on which his reputation as a writer chiefly rests, is his general history of poetry in all ages and countries: 'Storia e Ragione d'ogni Poesia,' 7 vols. 4to., Bologna and Milan, 1741-52, a laborious work containing a vast deal of information not found collected in any other compilation. The author treats at length of every branch of poetry, antient and modern. He divides poetry into melic or lyric, scenic or dramatic, and epic and didactic, each subdivided into numerous departments. Under the head of scenic poetry, besides the various sorts of tragedy and comedy, he treats of the numerous class of mimi and pantomimi, of the satirical drama, the Atellanæ, the rustic pastoral, maritime, piscatoriæ, sylvestres, and other fabulæ, and lastly of the musical drama or opera. He also treats at length of the rhapsody, the parody, the burlesque poetry of various kinds with which Italian literature abounds, of dialect, macaronic, and pedantic poetry: he quotes an immense number of writers, many of whom are little known; and he gives extracts from them. Quadrio's work, notwithstanding several mistakes and imperfections, is a very useful library book, and the composition of it occupied the author a considerable part of his life. Quadrio was of an infirm and susceptible temper, which involved him in sundry broils and disappointments, in consequence of which he sought and obtained leave to quit the order of the Jesuits, and assume the garb of a secular priest or abbé. He died at Milan in 1756.

QUADRU'MANA, Cuvier's name for his second order of mammiferous animals, an order which must be always viewed by the zoologist with great interest, inasmuch as it contains those forms among which will be found the nearest approach—though the distance is still great—to Man. [CHIMPANZEE; ORANG-UTAN.]

The order *Primates* of Linnæus consisted of the genera *Homo*, *Simia*, *Lemur*, and *Vespertilio*. [PRIMATES.]

Cuvier placed *Homo* aloof in his order *Bimana*, of which it is the only genus. His order *Quadrumana* embraced the *Singes* (*Simia*, Linn., including the Orangs) and the *Makis* (*Lemur*, Linn.); between these two extremes came the *Ouistitis* or *Arctopitheci*. [JACCHUS.]

Of his *Quadrumana*, Cuvier remarks that, independently of the anatomical details which distinguish them from man, they differ from him in the very striking character arising from their hind-feet having free thumbs, which are opposable to the other fingers, whilst those fingers are long and flexible, like those of the hand. They therefore climb trees with facility; but they do not hold themselves or walk erect except with difficulty, their foot in such case not resting on the sole, but on its external edge, and their narrow pelvis not favouring equilibrium in that posture Their intestines, he observes, are sufficiently similar to ours, their eyes are directed forward, they have mammæ on the breast et penem pendentem. The cerebrum has three lobes on each side, the posterior of which covers the cerebellum, and the temporal fossa is separated from the orbit by a bony partition; but for the rest, they recede gradually from the form of man, assuming a more elongated muzzle, a tail, and a progression more and more exclusively quadruped. Nevertheless, adds Cuvier, the liberty of their forearms and the complication of their hands permit among them all many actions and gestures similar to those of man.

Illiger's first order, *Erecta*, like Cuvier's *Bimana*, included man alone. His second order, *Pollicata*, consisted of the *Quadrumana*, the *Prosimii*, the *Macrotarsi*, the *Leptodactyla*, and the *Marsupialia*.

The *Quadrumana* embraced the Orangs and *Simiæ* generally, including *Hapale* (the *Jacchus*).

Mr. Gray divides the *Primates* into the *Anthropomorphous* and *Quadrupedoid*.

The first family of the first division, *Hominidæ*, is thus subdivided ·—

†

Tail none.

1. Hominina, *Homo*. 2. Simiina, *Troglodytes*, Geoff.; *Simia*, Linn.; *Hylobates*, Ill.

††

Tail long or short.

3. Presbytina. *Presbytes*, Esch.; 4. Cercopithecina, *Lasiopyga*, Ill.; *Cercopithecus*, Linn.; *Cercocebus*, Geoff.; *Macacus*; 5. Cynocephalina, *Cynocephalus*, Briss.; *Papio*, Briss.

The second family, *Sariguidæ*, is thus subdivided ·—

†

Tail end naked.

1. Mycetina, *Mycetes*, Ill.; 2. Atelina, *Ateles*, Geoff.; *Brachyteles*, Spix; *Gastromargus*, Spix; *Lagothrix*, Geoff.

††

'Tail end hairy.

3. Callithricina, *Cebus*, Erxl.; 4. Saguinina, *Saguinus*, Lacép.; *Nyctipithecus*, Spix; *Pithecia*, Geoff.; *Brachypus*, Spix; 5. Harpalina (Hapalina?), *Jacchus*, Geoff.

Under the *Quadrupedoid* division, Mr. Gray arranges the *Lemuridæ*, the *Galeopithecidæ*, and the *Vespertilionidæ*.

Under the *Quadrumana*, or *Tetracheirs* (his second order), M. Lesson arranges the *Simiæ* and *Lemuridæ* generally, together with *Loris*, *Nycticebus*, *Galago*, *Tarsius*, *Cheiromys*, and *Cheirogaleus*.

His first order, *Bimana*, includes man only.

The *Quadrumana* form the first order of the system of Mr. Swainson, who excludes man from the zoological circle. His *Quadrumana* consist of the following families and genera:—

1. Simiadæ.

Simia (including *Troglodytes*, *Hylobates*, *Presbytes*, and *Pithecus*, as subgenera).

Cercopithecus (including *Lasiopyga*, *Semnopithecus*, *Colobus*, *Cercopithecus*, *Cercocebus*, and *Nasalis*, as subgenera).

Inuus.

Macacus.

Papio (including *Papio* and *Cynocephalus* (Cynocephalus?) as subgenera).

2. Cebidæ.

Mycetes; *Lagothrix*, *Ateles*, *Cebus*, *Callithrix*, *Hapales* (including *Midas* as a subgenus), and *Pitheci*

3. Lemuridæ.

and

4. Vespertilionidæ.

Under the article CHEIROPODA will be found a notice of Mr. Ogilby's views regarding the *Quadrumana*, as far as they had then gone. Those views have since been carried out by that gentleman in the 'Natural History of Monkeys, Opossums, and Lemurs,' being the third volume of 'The Menageries,' in the 'Library of Entertaining Knowledge.' The following table exhibits the respective groups and families, with their relations in a regular and connected series:—

- CHEIROPEDS... (*Mammals with opposable thumbs*)
  - I. BIMANA (*on the fore hands only*) ... Homo.
  - II. QUADRUMANA.. (*on both fore and hind hands*)
    - SIMIÆ........ (*and anthropoid teeth*)
      - Troglodytes.
      - Satyrus.
      - Hylobates.
      - Semnopithecus.
      - Colobus.
      - Cercopithecus.
      - Papio.
      - Cynocephalus.
    - LEMURIDÆ .... (*and abnormal teeth*)
      - Lichanotus.
      - Propithecus.
      - Lemur.
      - Otolicnus.
      - Cheirogaleus.
      - Stenops.
      - Tarsius.
      - Cheiromys.
      - Galeopithecus.
    - SIMIADÆ ..... (*and anthropoid teeth*)
      - Cebus.
      - Ateles.
      - Mycetes.
      - Lagothrix.
      - Callithrix.
      - Aotus.
      - Pithecia.
      - Hapale.
  - III. PEDIMANA ... (*on the hind hands only*)
    - DIDELPHIDÆ.. (*and abnormal teeth*)
      - Phascolarctos.
      - Phalangista.
      - Petaurus.
      - Didelphys.
      - Cheironectes.
      - Dasyurus.
      - Phascogale.

The leading forms of the *Quadrumana*, and indeed most of the genera, will be found under their respective titles in this work.

QUAESTOR (from *quaero: 'qui conquireret publicas pecunias et maleficia,'* Varro, *De Ling. Lat.*, iv. 14) is a name which was common to two distinct classes of officers at Rome, who were only distinguished from each other by different attributes: the name of one class was *quaestores parricidii*; that of the other, *quaestores classici*. As the former class of these officers ceased to exist about the time of the Licinian law, and as the characteristic epithet was not always added by the earlier writers, the two offices were frequently confounded by subsequent authors, such as Tacitus and Ulpian.

The origin of the *quaestores parricidii* was traced by some writers back to the earliest period of Roman history, and it is said that the office of *quaestores parricidii* existed even in the reigns of Romulus and Numa. Livy (i. 26) and Tacitus (*Annal.*, xi. 22) think that they were appointed by the kings; but it is more probable that the kings only proposed the candidates, and that they were appointed by the populus. (Ulpian, 'De offic. Quaest.,' *Dig.*, i. 13.) That the office existed in the reign of Tullus Hostilius is certain, and the general opinion among the Romans was that it was instituted by that king. After the establishment of the republic, the two quaestores parricidii continued to be elected in the comitia of the curies, on the presentation of the consuls, as they were before on that of the kings; but they were now regularly elected every year, whereas before they had only been appointed in cases of emergency. After the decemvirate, they were elected by the centuries. At the time of the Licinian law one part of their functions was swallowed up by the office of the triumviri capitales, while the rest were embodied in the offices of the curule aediles and the tribunes.

The *quaestores parricidii*, according to Niebuhr, were the same as the *duumviri perduellionis*, but Walter (*Gesch. des Röm. Rechts*, p. 855) has adduced a number of passages which seem clearly to prove that the *quaestores parricidii* must be distinguished from the *duumviri perduellionis*, who continued to be elected to the end of the republic, and were real judges in cases of perduellio. The former, on the other hand, were a kind of public accusers, who conducted the accusation and carried the sentence into execution. (Festus, s. v. 'Parici;' Dionys. Hal., viii. 78.) They had also to assemble the comitia of the centuries to sit in judgment on any criminal accused of a capital offence (Varro, *De Ling. Lat.*, v. 9), for which purpose they sent a trumpeter, who proclaimed the day of meeting from the Capitol, at the gates of the city, and at the house of the accused.

The *Quaestores classici* had the superintendence of the public treasury, and are said to have been instituted by Valerius Publicola, who gave the right of electing them to the populus. At first they were only two in number, but in the year 421 B.C. their number was doubled (Liv., iv. 43), and part of them were to be plebeians, but this was not the case until ten years afterwards, when three out of the four quaestores were plebeians. (Livy, iv. 43, 54.) From the time that four quaestores were elected, two accompanied the consuls into the field, while the two others remained in the city (quaestores urbani). After the Romans had made themselves masters of all Italy (489 B.C.), the number of quaestores was again doubled, so that there were now eight of them (Liv., *Epit.*, lib. xv.), for the administration of the financial affairs in the city, in the army, in Italy, and the province of Sicily. One of them, who resided at Ostia, had also to provide the city with corn. (Cic., *pro Sext.*, 17.) Sulla in his dictatorship raised their number to twenty, and Cæsar to forty. (Tacit., *Annal.*, l. c.; Dion Cass., xliii. 47, 51.) During the time of the emperors their number varied. The two quaestores urbani, down to the time of Julius Cæsar, had the administration of the public treasury; they registered the revenue and expenditure of the republic (Ascon. Ped. on Cic., *in Verr.*, ii. 1, p. 158, ed. Orelli; Plut., *Cat. Min.*, 17, 18), received the money due to the state, and made the payments sanctioned by the senate. They had also to receive and take under their especial protection all foreign ambassadors, and those strangers who were connected with the state by ties of public hospitality; finally they had the care of the funerals and monuments which the senate decreed as distinctions for men of great merit (Plut., *Quaest. Rom.*, 43; Val. Max., v. 1, 1; Cic., *pro Flacco*, 18): they kept in the treasury the books in which the senatus consulta were copied, until Augustus also entrusted them with the keeping of the original documents. (Dion Cass., liv., 36.) Julius Cæsar transferred the administration of the treasury from the quaestores to two aediles. (Dion Cass., xliii. 47.)

The military quaestores who accompanied the consuls into the field (Cic., *in Verr.*, ii, 1, 15) had the charge of the money with which the war was carried on, distributed among the soldiers their provisions and pay, and superintended the sale of the booty, the produce of which was either divided among the soldiers or lodged in the public treasury. (Livy, iv. 53.) They had however to give in an account of all their proceedings to the treasury. Cic., *in Verr.*, ii. 1, 14; and Ascon. Ped., p. 167, ed. Orelli.)

With the extension of the Roman empire, a greater number of quaestores was required for the financial administration of the conquered countries and the provinces, and it was chiefly owing to this that their number increased in proportion as the empire became greater. The praetor was therefore usually accompanied in his province by a quaestor, who had the whole financial department under his control, but was, like the other quaestores, accountable to the treasury; in case of his death, the praetor appointed a proquaestor in his stead. (Cic., *in Verr.*, ii. 1, 15.) When the praetor was absent from his province, the quaestor usually supplied his place, and was then attended by lictors. (Cic., *ad Fam.*, ii. 15; *pro Planc.*, 41.) In the consulship of Decimus Drusus and Porcina, the senate decreed that it should be decided by lot which of the quaestors were to be sent into the provinces. (Ulpian, *Dig.*, l. c.) This law was, with very few exceptions, observed until the end of the republic. There seems to be no doubt that the quaestors at all times, after the year of their office was over, had a right to take their seats in the senate; of Sulla it is expressly said that he raised their number to twenty, for the purpose of filling up the vacancies in the senate.

In the time of the emperors we have mention of some quaestors who bore the title of Candidati principis, and who were not sent into provinces, but had only to read in the senate the communications which the emperor had to make to that assembly. From the time of the emperor Claudius it became customary for quaestores, on entering upon their office, to give gladiatorial spectacles to the people, and accordingly none but the wealthiest Romans could aspire to the office.

The quaestores, in the provinces of the Populus Romanus, had the jurisdictio of the Curule aediles, and consequently the right of promulgating edicts. No edicts were promulgated in the provinces of the Caesar. (Gaius, i. 6.)

QUA'GLIO, DOMENI'CO, who has been called the German Canaletto, was of a family that has produced several generations of artists, and whose place of origin was Luino, or Luvino, near the Lake of Como. Their ancestor, Julio Quaglio, was a fresco-painter of some note, who followed the school of Tintoretto, in which his father is said to have been educated, and who executed many altar-pieces and other works at Vienna, Salzburg, and Laybach. Lorenzo Quaglio, who was born at Luino, July 25, 1730, accompanied his father, Giovanni Maria, to Vienna, where the latter was engaged as engineer and architect in the imperial service, and where Lorenzo himself was brought up to the latter profession. He erected the theatre at Mannheim, and that at Frankfort, besides many other buildings, which are esteemed for their superior taste: he died at Munich, May 7, 1804. This Lorenzo left a son, named Giovanni Maria (born 1772), who was a distinguished architectural and scene painter. Domenico, the brother of Lorenzo, who was himself an historical painter, had two sons, Julius, an admirable scene-painter at Munich (died January 28, 1800), and an elder son, Joseph (born 1747, died at Munich, January 23, 1828), who was even more eminent than his brother, both as a scene-painter and in decoration generally. Joseph had four sons, Angelo, Domenico (the subject of this article), Lorenzo (born December 19, 1793), and Simon (born October 23, 1795). Angelo, who died April 2, 1815, at the age of thirty-seven, was also a scene-painter of extraordinary genius, and some of his productions are described as having had a most astonishing effect, particularly one representing the illumination of St. Peter's at Rome, after studies made by him on the spot.

Domenico was born at Munich, January 1, 1786, and began at a very early age to manifest a fondness for art, especially for perspective and architectural painting. With his father for his instructor, and with his own instinctive feeling to urge him on, he not only made rapid proficiency in the above-mentioned studies, but devoted his leisure to drawing from the life model, to landscape and sketches from nature, and to etching and engraving. In fact he was in some danger of aiming at excellence in too many departments of art, had he not, by the advice of his brother Angelo, determined to devote himself more especially to one. Having imbibed a strong taste for the architecture of the middle ages from Angelo's own drawings of the cathedral of Cologne (made for Sulpico Boisserée's splendid work), he resolved to make the buildings of that period the chief subjects of his pencil. With this view he made an architectural tour to Freising and other places, studying their interesting monuments of Gothic architecture. These furnished him with a stock of subjects for paintings on his return, and among the rest for his picture of Regensburg cathedral, which was purchased by Maximilian, the late king of Bavaria, who exhorted the artist to confine himself to the new branch which he had so successfully commenced. Following this advice, which was seconded by that of many other able judges, Quaglio resigned, in 1819, his situation and salary as scene-painter at the Munich theatre, and thenceforth applied himself solely to architectural painting, in which branch of art he gradually established a reputation throughout Europe, and at the same time was not a little instrumental in promoting by his works that taste for the architecture and arts of the middle ages which has of late years taken root in Germany. Independently of their value as portraits of some of the finest productions of German-Gothic architecture, his works are marked by striking picturesque effect. Besides his pictures, which are very numerous, he executed many etchings and lithographic views, and among the latter a series of thirty subjects, entitled 'Denkwürdige Gebäude des Deutschen Mittelalters.' In 1829 he accompanied Mr. Gally Knight in a tour to Italy as his architectural draftsman. He died at Hohenschwangau (where he was employed in restoring and improving the castle), of an apoplectic attack, April 9, 1837.

QUAIL. [Perdicidæ, vol. xvii., p. 438.]

QUAINI, FRANCESCO, was born in 1611, at Bologna, and studied under Agostino Mitelli, by whose instruction he acquired great skill in perspective and in painting architectural views. The public edifices at Bologna contain several of his works, the most admired of which are the representations of ornamental architecture in the Sala Farnese in the Palazzo Publico.

QUAINI, LODOVICO, the son of Francesco, was born at Bologna, in 1643. After having acquired the rudiments of the art and a knowledge of perspective from his father, he became a disciple first of Guercino, and afterwards of his relation Carlo Cignani, in whose school he was contemporary with Marc Antonio Franceschini. His improvement was so great, that in a few years he was employed, as well as Franceschini, to assist Cignani in the execution of some of his great works. Their method of handling and colouring was so similar, that it was difficult to determine what part of any work was executed by either of them. In Cignani's principal works however it seems that Quaini painted the landscape, the architecture, and other ornaments, and Franceschini the figures. After Cignani's death the two artists continued to work together. They were employed at Bologna, Modena, Piacenza, Genoa, and Rome, where they painted the cartoons for a cupola in St. Peter's, which has since been executed in mosaic.

Quaini also painted many historical subjects from his own compositions, which were entirely finished by himself. In the church of St. Joseph at Bologna there is a picture of the Visitation; in La Carità, the dead Christ supported by the Virgin; and in the church of St. Nicholas the principal altar-piece is by Quaini – it represents that saint in prison visited by the Virgin and an angel, and is favourably spoken of by Lanzi. He died in 1717, aged 74.

QUAKERS, the name first given 'in scorn,' and since habitually, to the sect of Christians who call themselves the 'Society of Friends.' [Fox, George, vol. x., p. 396.]

Origin.—The founder, or rather the first member of this Society was George Fox, who towards the middle of the seventeenth century, after long wanderings about the country and much spiritual conflict and inquiry into the merits of the sects then raging against each other in England, separated himself from all, feeling that 'none could speak to his condition.' By degrees his religious opinions assumed a distinct form, and in the year 1647, when he was 23 years of age, he commenced his ministry by preaching at Dukinfield near Manchester. In a short time the number of believers in his doctrines increased; in 1648 large meetings attended his ministry in Nottinghamshire, and, notwithstanding cruel persecution, the Society spread from the poor and uninstructed to many of the more opulent and educated classes.

It is not our intention to describe the process by which George Fox was led to adopt his peculiar opinions, or the course of conduct which these induced him, whilst yet a very young man, to pursue. Such a narrative might cast on the sect an air of extravagance, which belongs less to this body in particular than to the period of religious excitement in which it had its rise. Notwithstanding instances of indiscretion or enthusiasm in some of its first members, the early history of the Society is full of examples of undaunted courage in passive and ultimately successful resistance to oppression.

Tenets.—The Society of Friends have no articles or creed subscription to which is required of their members. Their principal tenets may however be gathered from the writings of George Fox, William Penn, and Robert Barclay, and their other approved authors, and from the minutes and epistles issued by their yearly meeting in London to the subordinate meetings.

They believe that it is the prerogative of God alone to declare himself to man; and therefore they prefer expressing their religious opinions in the language of Holy Scripture. In full accordance with these sacred writings, they have ever believed that there is one God and Father of all, of whom are all things; that there is one Lord Jesus Christ, by whom all things were made, who was glorified with the Father before the world was, who is over all, God blessed for ever; that there is one Holy Spirit, the promise of the Father and the Son, the Leader, Sanctifier, and Comforter of his people: and that these three are one God. Whilst objecting to scholastic terms and distinctions, and to all attempts to be wise in the deep things of God, beyond what He has plainly revealed, they have ever professed their belief in the real manhood as well as the true deity of our Lord and Saviour Jesus Christ; that the Word which was in the beginning with God, and was God, was made flesh and dwelt amongst men. They maintain that man in the fall is separated and alienated in his nature from God; that all have sinned and come short of the glory of God, and are therefore exposed to divine wrath; and that it is solely through the mercy of God in Christ Jesus that any are brought into reconciliation with him; receiving remission of sins through faith in the one propitiatory offering of the Lamb of God, and sanctification of heart through the influences of the Holy Spirit. They believe the Holy Scriptures to be given by inspiration of God, and to be profitable for doctrine, for reproof, for correction, for instruction in righteousness; and they have always professed their entire readiness that their tenets and practices should be tried thereby.

But that which may be regarded as the doctrine mainly distinguishing them from other Christians, is what they apprehend to be a fuller recognition both of the universality and of the teaching of the Holy Spirit. They believe that the light of the spirit of Christ does in measure enlighten every man that cometh into the world; that the effects of the death of Christ are coextensive with those of Adam's transgression, according to the declaration of the apostle, 'As in Adam all die, even so in Christ shall all be made alive;' and, as a consequence hereof, that even those who have not the outward knowledge of the Gospel history may, by giving heed to their measure of this light, become partakers of that salvation which comes by Jesus Christ.

They moreover believe that the guidance of the Holy Spirit is to be experienced by every sincere believer in Christ, in reference both to his religious duties and to his daily walk in life,—that to be guided by the Spirit is the practical application of the Christian religion. They also maintain that this manifestation of the Spirit, given to every man to profit withal, is the only essential qualification of the Christian for service in the church, and is independent of human choice or appointment. They hold it to be the prerogative of Christ to call and qualify by the Holy Spirit his servants to minister in word and doctrine, and that, as in the earliest period of the Christian church, this Spirit was poured upon servants and upon handmaidens, so he continues to call from *women* as well as from men, from the young and from the old, from the unlearned and from the poor, from the wise and from the rich, those whom he commissions to declare unto others the way of salvation. As such have freely received the gift of the ministry, so are they freely to give without hire or bargaining, far less to use it as a trade to get money by. Hence they refuse the payment of tithes and all other ecclesiastical imposts. They believe that the true worship of God is offered in the inward and immediate moving and drawing of his own Spirit; and that all other worship, beginning and ending in man's pleasure, ought to be rejected. Hence they abstain from the use of all prescribed forms of prayer, and refuse to observe appointed days of thanksgiving, or of fasting and humiliation. They believe that as all the types and shadows and ordinances of the law were fulfilled in Christ, so he established no new ordinances to be administered or to be observed in his church, that his baptism is that of the Holy Ghost and of fire. that he himself is the bread of life, and that the communion of his body and blood is inward and spiritual, and that in thus partaking of the substance, the figures are no longer needed. They assert that as God hath assumed to himself the dominion of conscience, all punishment for conscience sake is therefore contrary to the truth; provided that no man under the pretence of conscience prejudice his neighbour. They believe that true religion delivers man from the spirit and vain conversation of this world, and leads him to inward communion with God; and that hence all foolish and superstitious formalities and all frivolous recreations ought to be rejected: thus all public rejoicings are disapproved of.

Friends deem the taking of all oaths unlawful, and much of their sufferings arose from the firmness with which in former days they refused the oaths often wantonly tendered to them. They believe too that all wars and fightings are inconsistent with pure Christianity, and they refuse all participation directly or indirectly in them. They believe marriage to be a divine ordinance, but in their marriages they do not use the intervention of a minister, for whose interference they allege that there is no Scripture warrant. When any of the Society intend to marry, they acquaint their respective men's and women's meetings of their intentions, and the necessary inquiries having been made as to the consent of parents, the freedom of the parties from all previous engagements, and, if the woman is a widow with children, as to the security of a due provision for these, the parties in a public meeting for worship solemnly take each other in marriage, and a certificate of the fact is given to them. Friends abstain from all pomp in the burial of their dead and from the use of mourning apparel or of grave-stones. They do not use the heathen names of the days or months, but designate them by their numbers; and they object to address an individual in the plural number, or by his title of courtesy, or by any designation which they consider as either inconsistent with Christian truthfulness, or as irreverent or merely complimentary; but they have no scruple against the use of the simple names of dignity or office.

Discipline.—The discipline of the Society was at least indicated and to a great extent established by George Fox with much foresight; for notwithstanding the great increase of the body and the altered circumstances of the times, the system has been found adequate to the protection and the government of the Society.

The members of one or more congregations (according to their size) hold monthly meetings for looking to the orderly conversation of the members, for taking care of their poor (a duty which the Society rigidly fulfils to the superseding of all parochial relief), for regulating the proceedings in relation to marriage, and for other matters affecting the well-being of the body.

There are quarterly meetings throughout the nation, to which representatives are sent from the subordinate monthly meetings. There are also monthly and quarterly meetings of women Friends similarly constituted.

There are meetings for worship on Sunday, and in the forenoon of one other day in the week. The epistle from the yearly meeting in 1675 exhorts Friends not to decline, forsake, or remove their public assemblies because of times of suffering; for such practices are not consistent with the nobility of truth.

Finally, there is a yearly meeting of representatives from all churches of the Society throughout Great Britain and Ireland. This meeting is held in London on the Wednesday after the third Sunday in May, and remains sitting many days It receives reports of the state of the particular churches, and it issues to them a general epistle. A similar representative body or yearly meeting of women Friends is held at the same time for the general supervision of the religious state of those of their own sex, but they have no power to make rules for the government of the body. During the intervals of the yearly meeting, the general business of the Society is conducted by a meeting termed the Meeting for Sufferings, which is a carefully selected standing committee of the yearly meeting. There is a general fund belonging to the Society, called the national stock; it is formed by the voluntary contributions of members, and it is applied to the publication of religious works, the expenses attending applications for legislative relief in cases of suffering, the payment of the expenses of ministers travelling in foreign parts out of the limits of any meeting, and other public objects of the Society.

Whilst it is the duty of the individual members of the Society generally to watch over one another in love, this duty is more especially confided to certain officers of each sex in the respective meetings, who are called overseers, and who, whenever any case of delinquency comes to their knowledge, visit the individual privately, and labour with him in tenderness with a view to his restoration; but if these efforts prove unavailing, they are to bring the case to the monthly meeting, which appoints a committee to exercise further care in reference to it; and if all attempts at reclaiming the offender should fail, he is disowned as a member of the Society by a document issued by the monthly meeting and signed by its clerk.

There are many wise provisions made by the Society for exercising care over those who believe themselves called to the work of the ministry. This care is more especially entrusted to the elders, who are persons chosen for their spiritual discernment, and from having given evidence by their fruits of the soundness of their faith. The eventual recognition or acknowledgment of ministers as such rests however with the monthly meeting at large, including all the men and women members of the congregation. Monthly meetings are cautioned not hastily to give certificates of competence to those who desire to travel in the ministry; but to take care that these are well approved at home, are of sound doctrine, of good conversation, and in unity with their own meetings.

This notice of the Society of Friends ought not to be closed without honourable mention of their constant efforts in the cause of humanity. George Fox recommended the establishment of two schools, one for boys at Waltham and one for girls at Shacklewell, 'for instructing them in whatsoever things were civil and useful in the creation;' and a care on this head has been maintained and extended of later time, there being at present several large schools supported by the Society for the children of Friends and those connected with the body in different parts of England and Ireland. Some of these are intended only for elementary learning and religious instruction, others embrace the higher branches of education, and some are connected with agricultural pursuits. The Lancasterian system of instruction has found among Friends some of its most zealous supporters. The minutes of the yearly meetings from 1727 to the present time abound in exhortations to repress the slave-trade and slavery. In 1761 members engaged in the slave-trade were disowned; and the Society, as a body and individually, have been unremitting in their labours to remove this stain from the nation.

(*Rules of Discipline for the Religious Society of Friends*, London, 1834; Sewel's *History of the People called Quakers*, London, 1834; Barclay's *Apology* (the edition used for this article is that of 1701, London); and *Memoir of the Life of George Fox*, 1839; also the articles Fox; Barclay; Penn.)

QUAKING GRASS is the name given to the various species of graminaceous plants belonging to the genus Briza of botanists. They derive their name from their spikelets being always in a state of tremulous motion in consequence of the weakness of the footstalks by which they are supported.

QUALITY (from the Latin *qualis*), in the common acceptation, comprises all attributes that can be given to a thing, with the exception of those of magnitude and quantity, and it matters not whether the attributes are essential to the thing or merely accidental. But in speaking of the qualities of things, we chiefly consider those by which they are distinct from other and similar things. This circumstance accounts for some expressions, such as 'a man or a person of quality,' in which the word quality is used synonymous with rank, as *the* quality by which in aristocratical countries one class of men is distinguished from all others.

Among the ten categories or fundamental notions of the philosophy of Aristotle, quality is the third; but Kant, who has reduced the ten categories of Aristotle to four, makes quality the second; and according to him it comprises the notions of existence, non-existence, and limitation, or of reality, negation, and limitation; that is to say, all things which come within the sphere of man's thought are, in the category of quality, either something or nothing, or something of which he can only say what it is not.

QUAMASH is the North American name of an eatable bulb, found in the plains of the Missouri, and called Camassia esculenta by botanists. It is a plant of the Liliaceous order, and is nearly allied to the European squill.

QUAMOCLIT, a genus of climbing ornamental plants of the natural family of Convolvulaceæ, chiefly found in the hot parts of America, but species are indigenous both in India and China. The genus is characterised by having a 5-leaved calyx. Corol somewhat salver-shaped, plicate, and 5-lobed. Stamens 5, inserted into the base of the corolla. Ovary 4-celled. Cells with single ovules. Style simple. Stigma capitate and bilobed. Capsule 4-celled, 4-valved. Seeds 4, erect. Climbing plants with the leaves alternate, cordate, entire, lobed, or pinnatifid; peduncles axillary; one or many flowers of a red colour. Q. vulgaris is common in every part of India, and, being a beautiful plant, has been cultivated in this country as a tender annual. The name of the genus has been taken from that of this species, which was Ipomœa Quamoclit, the latter name signifying dwarf-bean, because, though smaller, it resembles the kidney-bean in its habit.

QUANTITY. There is little here to add to what has been said in the article Magnitude. The quantity of anything is the answer to *quantus?* (how much?) and the considerations under Ratio are necessary to the precise answer. Mr. Mill, in his 'Elements of the Human Mind,' has invented the word *tantity*, since *quantus* (how much) is answered by *tantus* (so much); and he therefore uses quantity and tantity as correlative, or, as he terms them, connotative words. But in truth the meaning of *quantity*, as generally received, does not refer to the question, but to the answer; so that the word *tantity*, if introduced, could only mean the same thing as quantity, unless the meaning of the latter word were changed. If any one were to propose that quantity should signify what it does at present, with the addition of a reference to seeking, requiring, or asking, and that tantity should involve the same notion, its object being considered as found, given, or determined, undoubtedly the proposition would be a good one, considered apart from the difficulty of altering established meanings. The word quantuplicity, as distinguished from quantity, means the answer to how many times, as distinguished from how much. [Ratio.]

QUANTITY OF MATTER. [Mass.]

QUANTITY OF MOTION. [Momentum.]

QUARANTINE. Quarantine regulations are regulations, chiefly of a restrictive nature, for the purpose of preventing the communication from one country to another of contagious diseases, by means of men, animals, goods, or letters. The origin of the term *quarantine* (which originally signified a period of forty days during which a person was subject to the regulations in question) is explained in the article Lazaretto. The period of forty days during which a widow entitled to dower can remain in her husband's mansion-house after his death is also called, in our law, the widow's quarantine. (Blackstone's *Commentaries*, vol. ii., p. 135.)

Quarantine regulations consist in the interruption of intercourse with the country in which a contagious disease is supposed to prevail, and in the employment of certain precautionary measures respecting men, animals, goods, and letters coming from or otherwise communicating with it. Men and animals are subjected to a probationary confinement, and goods and letters to a process of depuration, in order to ascertain that the contagious poison is not latent in the former; and to expel it, if it be present, in the latter. Quarantine regulations respecting *men* and *animals* are therefore founded on the assumption that the contagious poison, after having been taken into the constitution of a man or an animal, may remain dormant in it for a certain time, and that a seclusion of a certain duration is necessary, in order to allow the disease time to show itself, or to afford a certainty that the disease is not there. Quarantine regulations respecting *goods* and *letters* are founded on the assumption that the contagious poison may be contained in goods and letters, and transmitted from them so as to communicate the disease to men.

The country from which the introduction of a contagious disease is apprehended, may either be conterminous with the country which establishes the quarantine regulations, or may be divided from it by the sea. Accordingly quarantine lines may either be drawn round a coast, as is the case in France, Italy, and Greece, with respect to the Levant, or they may be drawn along a land frontier, as on the frontier between Austria and Servia and Wallachia.

The contagious diseases which quarantine regulations are intended to guard against are plague and yellow-fever, and latterly cholera. We are not aware whether small-pox has ever been made a subject of quarantine regulations; but this question is now of no practical moment, since vaccination has supplied a preventive of small-pox far more efficacious than any quarantine regulations could be.

The most important disease, with reference to quarantine regulations, is the *plague of the Levant;* and in practice quarantine regulations are of little importance except with respect to the intercourse by land and sea with Turkey, Asia Minor, and Egypt, and some other of the Mohammedan countries bordering on the Mediterranean.

In the article Pestilence there is an explanation of the nature of the disease styled plague, which, although formerly prevalent over the whole of Europe, is now nearly confined to the Levant; and it is there stated that its symptoms, morbid changes, history, and mode of propagation, bear so close a resemblance to those of the malignant typhus of this country, that it is difficult to regard them otherwise than as different types of the same disease. [Vol. xviii., p. 15.] It is also shown in the same article that the plague of the Levant appears to be generated by the same causes which generate typhus in this country, namely, filthy, crowded, and ill-ventilated dwellings, want of personal cleanliness, defective drainage, and insufficient or unwholesome food (Report of Dr. Arnott and Dr. Kay, in the Appendix to the *Fourth Annual Report of the Poor Law Commissioners*, p. 103), and that when the disease has been thus generated, it may, particularly under the influence of any of the causes which originally produced it, be communicated from one person to another. It appears likewise that its communication from one person to another is promoted not only by filth, want of ventilation, and the other usual accompaniments of squalid poverty, but also by certain atmospheric causes, such as a certain state of heat, moisture, &c., respecting which we are as yet imperfectly informed. [Vol. xviii., p. 16.] The plague therefore is both epidemic and contagious; that is to say, it may either be generated by local causes, which simultaneously affect a large number of the inhabitants of a country, or it may be communicated directly from one person to another. Where a disease is both epidemic and contagious, it is difficult to determine what proportion of the cases of it are due to local causes and what proportion to contagion. The analogy of typhus in this country would lead us to believe that the number of cases of plague in the plague countries produced by contagion is small as compared with the number produced by local causes. The invisible nature of the ordinary causes of plague and other epidemic diseases, and the simultaneous seizure of many persons in the same district, the same street, or the same house, have naturally led to the belief that the disease is in every case communicated from one person to another; according to the fallacy ingeniously exposed by Dr. Radcliffe, who, on being asked his opinion respecting the contagiousness of epidemic diseases, answered: 'If you and I are exposed to the rain, we shall both get wet; but it does not follow that we shall wet one another.'

This view of the ordinary causes of plague is likewise confirmed by the undoubted fact which is adverted to in the article Pestilence, that the poor are the chief sufferers by it, and that it prevails most in the filthiest and worst quarters of towns. Since this fact is of much importance, we will cite the excellent testimony of Dr. Patrick Russell, in addition to what is said in the article Pestilence. Speaking of the plague at Aleppo in 1762, he makes the following remarks:—'The villages appeared to suffer in a singular degree, owing perhaps to the structure of the huts and cottages, which are small, with few or no windows, and stand crowded together. In this they resemble the Keisarias within the city, which are inhabited by the lower class of people, and in which the contagion spreads also with great fury. The inhabitants of the city of the same class, but who live in districts where the houses are less connected, suffered more than the middling class possessing more airy habitations, but less than the Keisarias. The people of rank, or in higher offices, *notwithstanding the promiscuous crowds frequenting their palaces*, suffered least of all. Neither the governors of the city, the cadi, nor the nakeeb, and very few of the agas of superior rank, were themselves infected, though the plague had penetrated into most of their harems, and many of the pages and other attendants without doors were carried off by it. In these great harems however the contagion seldom spreads much; of perhaps about forty females, not more than four or five being infected. . . . Of all people, the Jews appear to have the strongest dread of the plague, a circumstance in one light rather fortunate, no place being more favourable to its propagation than the habitations of the lower class of that nation. The houses are small, or, if large, the different apartments are crowded with different families. Many of the houses are more than a story below the level of the street, in a condition half ruinous, dirty in the extreme, damp, and badly aired, from the nature of the situation; and the wretched inhabitants are clothed in rags. When one of them is taken ill, and known to have the plague, he is immediately abandoned to the care of an attendant, and the rest of the family seek refuge, if possible, at some distance. The families lodged in the other apartments, all not having it in their power to fly, are obliged to remain, but avoid approaching the chamber of the sick, and restrain their children from going into the court yard. Thus pent up, they suffer all the inconveniences of the hot season in the midst of perpetual dread, till at length, what often happens, they also are attacked with the distemper. It was not without horror I descended into these dreary mansions.' (Russell's *Historical Journal of the Plague*, pp. 61-64.)

From the fact of the plague prevailing principally among the poor, and rarely attacking the rich, it may be inferred either that the plague is produced exclusively by the filth, crowding, and bad food to which the poor are subject; or that, if it be contagious, the contagion does not in general take effect upon the inhabitants of spacious and cleanly houses, who are clean in their persons, orderly in their habits, and have a sufficient supply of wholesome food. We see that diseases which appear to be contagious under nearly all circumstances, prevail equally among the rich and poor; and that none of the physical advantages possessed by the latter afford any security against it. Thus, before the introduction of vaccination, small-pox was equally destructive to persons of all ranks in society; and the contagious diseases which attack children, as measles and hooping-cough, make no distinction between the children of the rich and the poor.

There seems to us to be no reasonable doubt that the plague is contagious—in other words, that it can be communicated directly from one person to another—provided there be circumstances favourable to its transmission. A quarantine for men may therefore be expedient for countries where the spread of the plague, supposing it to be introduced, is not improbable. The duration of this quarantine ought to depend upon the time during which the disease may be latent in a person who has taken it by contagion or otherwise.

Since the plague is a peculiarly malignant and destructive fever, and runs its course with a rapidity far greater than typhus, there seems a fair ground for concluding that its poison would not be long latent in the human body. The answers of the protomedico of Malta respecting the plague in Malta of 1813, state that 'the periods at which the disease made its appearance in different individuals after communication were various. It was generally from the third to the sixth day; sometimes longer, even to the fourteenth day, but not later.' (Dr. Maclean, *On Epidemic and Pestilential Diseases*, vol. ii., p. 29.) M. Ségur Dupeyron, the secretary of the Council of Health in France, states, in his Report on Quarantine to the Minister of Commerce (May, 1834), that 'the physicians who have made a close study of the plague are pretty generally of opinion that its poison cannot be latent in the human body more than fifteen days; and the cases of plague introduced into the lazarettoes confirm this opinion' (p. 48). We believe that the cases of plague which have of late years occurred in the lazarettoes of Valletta, Marseille, and Leghorn have broken out either at sea or shortly after the ship's arrival. When the line of French steamers was first established, in 1837, between Marseille and the Levant, it was arranged that the steamers coming from the Levant should perform their quarantine at Marseille. But in consequence of several cases of plague having broken out on board the steamers before they could reach Marseille, the French government decided that they should perform their quarantine at the nearest practicable station, namely Malta.

It is commonly assumed that actual or nearly actual contact is necessary in order to communicate the plague. 'All measures against the plague (says M. de Ségur Dupeyron) are founded on the opinion that, except within a very small distance from the body, contact alone can give the disease. Consequently goods taken from ships with different bills of health are often placed in the same warehouse; and physicians who have visited plague patients, without having touched them, are not put in quarantine, and are permitted to go about immediately after their visit' (p. 76). We believe the idea that actual contact is necessary for the communication of the plague to be utterly erroneous; and we entertain no doubt that under circumstances favourable to its communication, such as filth, crowding, and want of ventilation, the poison of the plague might be introduced into the human body by inspiration through the lungs. We account for the escape of the physicians, guardians, and others, who come within a short distance of the plague-patients in lazarettoes, by the supposition that in the isolation, cleanliness, and good ventilation of a well managed lazaretto, the contagion of the plague is exceedingly feeble.

With respect to the quarantine of animals, it may be remarked that, according to the belief commonly received in the Mediterranean, all living animals are capable of communicating the plague. Accordingly horses, asses, cattle, and sheep are placed in quarantine upon their importation. There is, we believe, an idea among the Franks resident in the plague countries, that the horse cannot communicate the poison of the plague, but that it is frequently communicated by other animals, especially by cats. (See Maclean, vol. i., p. 202.) We suspect that there is no foundation for the notion that plague can be communicated by means of animals.

Goods carried in ships or by land are subject to quarantine, according as they belong to the class of susceptible or nonsusceptible goods. Goods which are supposed to be capable of containing and transmitting the poison of the plague are called *susceptible*. Goods which are supposed to be incapable of containing and transmitting the poison of the plague are called *nonsusceptible*. All animal substances, such as wool, silk, and leather, and many vegetable substances, such as cotton, linen, and paper, are deemed susceptible. On the other hand, wood, metals, and fruits are deemed nonsusceptible. In Venice an intermediate class, subject to a half quarantine, is introduced between susceptible and nonsusceptible goods (Ségur Dupeyron, p. 70); but this classification appears to be peculiar to the Austrian dominions. All susceptible goods are unladen in the lazaretto, and are there exposed to the air, in order to undergo a process of supposed depuration.

The grounds of the received distinction between susceptible and nonsusceptible articles must, we conceive, be altogether fanciful; since we cannot discover any evidence that the plague has ever been communicated by merchandise. Whenever the plague has been introduced into the lazarettoes of the Mediterranean, it has always been introduced by passengers or their clothes. (Ségur Dupeyron, p. 45-48.) It may be added, that the persons employed in the process of depurating susceptible goods have never been known to catch the plague, which could scarcely have failed to be sometimes the case if the poison of the plague could be transmitted through goods. (See answer 28 of the Maltese Protomedico, in Maclean, vol. ii., p. 31.) It seems to be likewise supposed that some substances are not only nonsusceptible, but can even nullify the poison of the plague in susceptible articles. 'At Trieste (says M. de Ségur Dupeyron), the juice of dried grapes is considered as a purifier; and consequently currants in susceptible wrappers are allowed to pass without the wrappers being subjected to any quarantine' (p. 72).

There appears however to be conclusive evidence that the clothes and bedding of plague patients have transmitted the plague. (Dupeyron, p. 32-71.) We believe the danger of its transmission in this manner to be equal to the danger of its transmission by passengers.

We are not aware of any well authenticated example of the transmission of plague by means of letters. Nevertheless, as paper is considered susceptible, letters coming from and passing through the plague countries, are opened and fumigated at the lazarettoes, a process which is often productive of mistakes, delays, and other inconveniences.

Every ship is furnished by the consul or other sanitary authority at the last port where it touched, with an instrument, styled a bill of health, declaring the state of health in that country. If the ship brings a clean bill of health, the passengers and goods are not subject to any quarantine. If she brings a foul bill, they are subject to quarantines of different durations, according as the plague is known or only suspected to have existed in the country at the ship's departure. On account of the prevalence of plague in the countries upon the Levant, they are considered as permanently in a state of suspicion, and no ship sailing from any of them is considered to bring a clean bill. The periods of quarantine vary from two or three to forty days; the usual periods are from ten to twenty days.

For a description of the buildings in which passengers usually perform their quarantine, and in which goods are depurated, see Lazaretto. The most spacious and best appointed lazarettoes in the Mediterranean are those at Malta and Marseille. To the statements contained in the article just referred to, we add the following curious description of a quarantine station on a land frontier, quoted from a MS. journal in Murray's 'Handbook for Southern Germany,' p. 457. 'Outside Orsova, by the waterside, and near the ferry over the Danube, stands the Parlatorium, a wooden shed in which the market (skela) is held three times a week. On account of the quarantine regulations, the inhabitants of Servia and Wallachia are prevented coming in contact with the subjects of Austria, and dare not cross the frontier without an escort. The Austrian quarantine is five days for those who come out of Wallachia, and ten for those from Servia, increased to forty days in time of plague. The Wallachians again have a quarantine of five days against the Servians; so that none of the three parties can intermix for the purpose of buying or selling, nor can they touch each other's goods. On this account the building where the market is held is divided by three partitions, breast high, behind which the dealers of the three nations are congregated. In an open space in the centre is a table, by the side of which the Austrian quarantine officers take their stand, aided and supported by a guard of soldiers with fire-arms and fixed bayonets to enforce order and obedience. Whenever a bargain is made, the money to be paid is handed to one of the attendants, who receives it in a long ladle, transfers it to a basin of vinegar, and after washing it, passes it on to the opposite side. The goods to be purchased are placed within sight, and are immersed in a tub of water, or fumigated, when they happen to change owners. It is an amusing sight to see the process of bargaining thus carried on by three parties at the distance of several yards from each other, attended by the vociferation and gesticulation inseparable from such business. When the bartering is transacted, the Wallachians are escorted back to their own territory, as they had previously been in coming to the spot by a guard of soldiers, and the Servians recross the river in their boats.'

The institution of quarantine originated at Venice, in which city the expediency of some precautions against the introduction of the plague was suggested by its extensive commercial relations with the Levant. A separate hospital for persons attacked by the plague was established in an island near Venice, in 1403; and the system of isolating passengers and depurating goods appears to have been introduced there about 1485. The system thus established in Venice gradually spread to the other Christian countries in the Mediterranean, and has been adopted, to a greater or less extent, over all the civilised world.

It is much to be desired that the plan of an inquiry, by competent medical authority, into the grounds of the existing quarantine regulations in the Mediterranean, to be conducted under the direction of the chief European powers (which has been suggested by M. de Ségur Dupeyron, Dr. Bowring, and others), should be adopted. It cannot be expected that the causes of plague and the mode of its communication will receive any light from the semi-barbarians who inhabit the Mohammedan countries of the Levant. Moreover, quarantine regulations cannot be changed without the consent of the different nations which are concerned in their enforcement. The reason why it is necessary for a nation to adapt its quarantine regulations to the received opinions upon the subject, is explained in the following extract from a paper respecting quarantine regulations in the Mediterranean, which was printed in the Malta 'Government Gazette' of the 19th December, 1838:—'The quarantine regulations of the English colonies in the Mediterranean cannot be changed by the simple will of the English government without producing inconveniences far greater than those arising from the existing system. If the English government should change the quarantine regulations of Malta and its other colonies in the Mediterranean without previously obtaining the approbation of the sanitary authorities of the neighbouring countries, the pratique granted in those colonies would not be received elsewhere; and all vessels coming from any of those colonies would be subjected to a quarantine of observation (from eight to fifteen days). The latter liability would attach to ships of the royal navy as well as to merchant vessels; so that no ship of war sailing from Malta could communicate with any part of France, Italy, or Austria, without being previously subjected to a quarantine of observation. Malta, in particular, would suffer most severely by being unable to give an effectual pratique to ships performing quarantine in the harbour of Valletta, and by subjecting all ships clearing out of that harbour to a quarantine of observation. Not only would its transit trade be almost completely destroyed, but it would lose its importance as a quarantine station. Its importance as a quarantine station is now daily growing, on account of the establishment of the French steamers to the Levant, and the use of the overland journey to India. It would however cease to be a quarantine station, if its pratique was not received by the Board of Health at Marseille, and by the other sanitary authorities of the Mediterranean. In order therefore that the quarantine regulations of the English colonies in the Mediterranean might be safely altered, it would be necessary that the alterations should be made in concert with the governments of the neighbouring European countries.'

The small states of Italy are suspected (and, we fear, with justice) of abusing quarantine regulations for the purpose of preventing commercial intercourse, and also for the sake of the profit to be made by farming out the quarantine dues.

But in Trieste, Marseille, and Malta the system is, we believe, perfectly free from all taint of corruption, and is maintained with the full concurrence of public opinion among the inhabitants of those towns. Indeed, it may be said that the popular jealousy is rather lest the restrictions should not be severe enough, than lest they should be too severe. It is therefore manifest that the system cannot be improved until the opinions upon which it is founded have undergone a thorough investigation.

The heads of the English law respecting quarantine are contained in the 6 Geo. IV., c. 78. This Act also confers upon the king in council extensive powers for making quarantine regulations. A full official abstract of the regulations established by this statute, and of the orders in council made under it, may be seen in M'Culloch's *Commercial Dictionary*, article 'Quarantine.'

QUARE I'MPEDIT. When an ecclesiastical benefice becomes vacant by the death, cession, &c. of the incumbent, unless the patron [ADVOWSON] present his clerk, that is, a clergyman, to the bishop of the diocese for institution, within six calendar months, the right will lapse to the bishop, who may collate to the vacant benefice. But if a presentation be made by the patron within the six months, and that presentation is rendered ineffectual by the bishop's refusal to institute the clerk presented, the patron may obtain redress for this interference with his right of patronage in an action of Quare impedit, a proceeding so called because the writ by which the action is commenced requires the defendant to state Quare impedit (why he hinders) the plaintiff from exercising his right of presenting to the vacant benefice. If the bishop be the sole disturber of the right, as is the case when he rejects the clerk upon an unfounded allegation of personal incapacity, as illiterature, immorality, &c., the action of Quare impedit is brought against the bishop alone. Where the bishop has instituted a clerk upon the presentation of a party wrongfully claiming to be patron, the action is usually brought against the bishop, the patron so claiming, and his clerk jointly; for unless the bishop be made a party to the suit, a title to present by lapse will accrue to him if the suit remain undetermined at the end of six calendar months from the death, &c. of the last incumbent, and the benefice remain vacant, and the clerk instituted is, in consequence of the want of title in his patron, shown to be an intruder. If the patron be omitted, the proceeding is void, inasmuch as the validity of the title under which he has presented, as opposed to that set up by the plaintiff, is the subject to be inquired into. If the clerk be omitted, there can be no process (in a suit to which he is no party) to remove him from the benefice in case he has been instituted, and is ultimately found to have been presented on an insufficient title; and the consequence will be that the plaintiff must lose his right of presenting to the benefice for the present turn.

The writ of Quare impedit commands the defendants to permit the plaintiff to present a fit and proper person (without specifying any partic[illegible] clerk) to the vacant church, vicarage, or other benefice of which he claims the patronage, and which the defendants, as it is alleged, obstruct; and unless they do so, then they are required to appear in the Court of Common Pleas, to show the reason why they hinder him. The defendants having been summoned, by delivering to them a copy of this writ, and having entered an appearance in the court, the plaintiff states his complaint more fully by his declaration, in which he must set out some former presentation to the same benefice, and if that presentation was not by himself, he must formally deduce a title to himself, by descent or purchase, from the party by whom the presentation on some former vacancy is alleged to have been made. The declaration must also show a disturbance before the bringing of the action. Upon this the bishop and the clerk usually disclaim all title, save only, the one, as ordinary, to admit and institute, and the other as presentee of the patron, who is left to defend his own right. But if the bishop has done more than he was bound to do as ordinary, especially where he has wrongfully collated the benefice, the plaintiff may, in his replication, allege special disturbance in the bishop for the purpose of making him a substantial defendant. If the plaintiff fail in making out his own title, the defendant is put upon the proof of his, in order to obtain judgment for himself if needful. But if the right be found for the plaintiff on the trial, the jury who try the cause are to inquire of three other points: 1st, Whether the church, &c. is full, and if full, of whose presentation; for if it be of the defendant's presentation, then the clerk is removeable, provided the writ has been brought in due time; 2nd, What the value of the living is, and this with a view to the assessment of damages, which are directed to be given by the statute (13 Ed. I.); 3rd, In case of plenarty (that is, of the benefice being full), upon a usurpation (wrongful presentation), whether six calendar months have passed between the avoidance (the occurrence of the vacancy) and the time of bringing the action; because the statute which permits a usurpation to be devested by a Quare impedit, does so only when the action is brought within the six months, and at common law plenarty was a bar to the action of Quare impedit, however early the action might have been commenced. If the jury find that the plaintiff had the right to present, and that his action was commenced within the six months, he has judgment to recover this presentation; and if the church, &c. be full by institution of any clerk, process issues to remove him, unless whilst the action was depending, the bishop (not having been made a party to the suit) has collated by lapse; in which case the plaintiff loses the present presentation, but is entitled to recover the full amount of the income of the benefice for two years from the defendant, the pseudo-patron, as a satisfaction for the turn lost by his disturbance; and in case of inability to pay, the defendant is liable to imprisonment for two years. But if at the termination of the suit the church still remains void, the party to whom the presentation is found to belong, whether plaintiff or defendant, may sue out a writ 'ad admittendum clericum,' by which, after reciting the judgment of the court in the action of Quare impedit, the bishop is commanded to admit and institute the clerk of the successful party. If, upon this writ, the clerk be not admitted, the patron may recover satisfaction in damages against the bishop in an action for such refusal.

The patron only, and not the clerk, can maintain an action against the disturber. But under several statutes passed in the reigns of James I., William and Mary, and Anne, which took away the right of presentation from Roman Catholic patrons, the clerks presented are empowered to take certain proceedings in support of their interests. The right of presenting to benefices belonging to Roman Catholic patrons is vested by those statutes in the universities of Oxford and Cambridge, according to a distribution of counties given in the act of James I.; most of the counties in the south and west of England being for this purpose annexed t Oxford, and those in the north and east to Cambridge. The 12 Anne, st. ii., c. 14, provides (s. 4) that besides the writs of Quare impedit which the universities as patrons are entitled to bring, they or their clerks may file a bill in equity against any person presenting to such livings and disturbing their right of patronage, in order to compel a discovery of any secret trusts for the benefit of Roman Catholics in evasion of these statutes: and also (by 11 Geo. II., c. 17) to compel a discovery whether grants or conveyances of such advowsons were made *bonâ fide* to a Protestant purchaser f the benefit of Protestants and for a full consideration; without which requisites every such grant and conveyance of any advowson is declared to be void. This is the only case in which the clerk is at liberty to interfere with the recovery of a presentation of which he is afterwards to have the advantage.

The statutes giving to the universities the right to present to benefices belonging to Roman Catholic patrons do not affect the exercise of the right of patronage in any other class. Dissenters, and even Jews and pagans, may exercise this right. When the disability was first created, persons professing the Roman Catholic religion were the only class from whom any danger in a political or religious point of view was apprehended; and the circumstance that persons who have been admitted to holy orders in the Church Rome are capable of holding benefices in the Church of England, may perhaps have increased the jealousy with which Roman Catholic patrons were regarded by the legislatur

It has lately been held that these statutes do not transfer any right of presentation to the universities where the patronage of a vacant benefice is vested in several parties, unless all of them be persons professing the Roman Catholic religion. If there be two patrons, one a Protestant and the other a Roman Catholic, the entire right of presentation vests in the former. (6 Bingham's *New Cases*, 146.)

By 3 & 4 Will. IV., c. 27, § 30, it is enacted that no person shall bring any Quare impedit or other action, or any suit to enforce a right to present to or bestow any church, vicarage, or other ecclesiastical benefice, as the patron thereof, after the expiration of the period during which three clerks in succession shall have held the same, all of whom shall have obtained possession thereof adversely to the right of presentation or gift of such person, or of some person through whom he claims, if the times of such incumbencies taken together shall amount to the full period of sixty years; and if the time of such incumbencies shall not together amount to the full period of sixty years, then after the expiration of such further time as with the times of such incumbencies will make up the full period of sixty years.

QUARENGHI, IL CAV. GIACOMO, was born at Bergamo, September 20, 1744. He received a liberal education, and early displayed a turn for poetical composition, besides a taste for the fine arts, among which last he may be said to have been domesticated from his infancy, both his father and grandfather being painters. He was accordingly destined for the same profession, and when sufficiently advanced, was sent to pursue his studies at Rome, where he became a pupil of Mengs, and afterwards of Stefano Pozzi. But he subsequently abandoned painting for architecture, for his attainments in which he appears to have been more indebted to his own application and love of the study than to the instruction of those under whom he successively placed himself for instruction. According to the biographical memoir by his son Giulio, prefixed to the folio volume of his designs (entitled 'Fabbriche e Disegni,' &c., Milano, 1821), he soon became known in his profession, and obtained a great many (moltissime) commissions while he continued at Rome, but none of them are further specified; neither is the precise time stated when he left Italy for St. Petersburg, whither he had been expressly invited by the empress Catharine II. Consequently, for want of that and other dates, the memoir is strangely imperfect, since it gives no chronology of his professional life; neither is it always very clear what designs in the collection have been executed, and what are merely projects. In fact, neither the time of his return to Italy nor even that of his death is stated in the memoir by his son, nor are we able to supply such singular omission any further than in regard to the last event, which happened in 1817.

Though Quarenghi obtained a very high reputation in Russia, his published designs afford very little evidence of superior taste or ability, or even of novelty in invention. Judged from them, he appears to have been a great mannerist, and to have bestowed very little study on his details, which, besides being nearly the same on all occasions, are meagre and poor, even to insipidity. In comparison with many of his countrymen, he may be said to have been pure in his style of composition, but his merits are little more than negative; for if there is nothing glaringly offensive in his productions, neither are they stamped by any particular beauties and merits. Like that of James Wyatt, his purity is for the most part only poverty, his simplicity only the mere antithetical fault to excessive redundancy of ornament. The grandeur of his buildings consists chiefly in their size, and in their being kept in bold masses; but if not broken up, neither are they finished. They have insulated columns and ample prostyles, porticos Ionic or Corinthian, but frequently attached to buildings which are in other respects quite in a state of nudity—bare walls with holes in them for windows. Among his principal works are the Theatre of the Hermitage, the manège or riding-house of the imperial guards in the Isaac's Place, at St. Petersburg, the convent of Demoiselles Nobles, Prince Gagarin's palace, and the triumphal arch in honour of the emperor Alexander, designed by Quarenghi, but not executed in stone till after his death.

QUARLES, FRANCIS, was born in 1592, of a good family in Essex, educated at Christ College, Cambridge, and Lincoln's Inn. Before the Irish rebellion, in 1641, he was Usher's secretary, but at that time he was forced to fly to England, where he met with persecution from the parliamentary party for his attachment to king Charles. Among other things, they plundered him of his books, which is reported to have hastened his death on September 8th, 1644.

His works are now neglected, with one exception, that of his 'Emblems,' which have been many times reprinted, and are sought after by some for their quaintness, by others for their piety. His other works are fifteen at least in number, many of them on scriptural subjects. Quarles had eighteen children, of whom one inherited somewhat of his father's poetical genius, shared the royal fortunes, and died of the plague in 1665.

The quaint conceits of the divines who lived after the Reformation found in Quarle's writings their poetical vehicle. There is much fine feeling, sincerity, and humility shown in many of his compositions, but these qualities do not make up poetry, unless accompanied by a creative power, which is not very traceable in Quarles.

There is a great tendency now-a-days to weigh poetry in the scales of theology, a procedure which implies want of appreciation of the true nature of the art. That our noblest aspirations take the form of religious thought cannot be doubted, but the expression of doctrines, themselves often metaphorical, by coarse corporeal figures conveyed in wood-cuts, is a very different thing from indulging in feelings the very existence of which exalt the character of man. (Chambers's *Biogr. Dictionary;* Quarles's *Poems.*)

QUARRY, an excavation in the ground from whence are extracted marble, stone, or chalk, for the purposes chiefly of sculpture and architecture. The name appears to have been applied to such excavations from the circumstance that the materials obtained from them are there quadrated or formed into rectangular blocks.

Egypt abounds with rocks of calcareous stone, sandstone, and granite [EGYPT]; and all these materials have been employed in the formation of the massive works which yet remain to attest the magnificence of the antient people of that country. The walls of most of the temples were constructed of sandstone, which appears to have been chiefly obtained from the quarries stretching along the banks of the Nile, in the mountains of Silsileh; but the obelisks and statues which adorned those temples are formed of Syenite, or Oriental granite, drawn from the quarries in the islands of Philæ and Elephantine, and particularly from those vast excavations in the mountain terraces about Syene. (On this subject, see 'Egypt. Antiq.,' *Library of Entertaining Knowledge.*) The stone which has served for the pyramid of Cheops is a carbonate of lime, of a light grey colour, and the same kind of stone forms the interior mass of the pyramid of Mycerinus, but the latter is covered with red granite The monolith at Sais, in the Delta, was formed of a single block of granite, which was floated down the Nile on a raft, from the quarry in Elephantine. (Herod., ii. 175.)

The master-pieces of Grecian sculpture were executed in the rich white marbles of Attica and the islands of the Archipelago. The quarries of Mount Pentelicus near Athens supplied the materials for the Parthenon and the temple of Theseus in that city, and for the temple of Ceres and Proserpine at Eleusis; and both in Greece and Asia Minor an abundance of stone of a greenish white was dug from the earth for the ordinary purposes of architecture. The marble of Pentelicus, which lies on the surface of the rocky mountain, was obtained by cutting the side of the hill into vertical cliffs; and about the foot of the escarpment there still remain some of the blocks of marble partly cut in forms for the shafts of columns. The quarries at Ephesus are said to have constituted an immense labyrinth; and that in the hill Epipolæ, with the stone from which the edifices of Syracuse were constructed, appears to have been of vast extent, since it was capacious enough to contain the 7000 Greek soldiers who had been taken prisoners when the army of Nicias retreated from that city. (Thucyd., vii. 86.) The quarries of the Greeks and Romans were worked by slaves, and as the labour was of a severe kind, we find frequent allusions to the practice of sending unruly slaves to work in the quarries as a punishment.

We learn from Vitruvius (lib. ii., cap 7) that the buildings of antient Italy were constructed with stones of several. different kinds. This writer states that the quarries of Alba and Fidenæ (*Albano* and *Castel Jubileo*) produced a red and soft stone which soon decayed; and that the stone obtained from those of Tibur (*Tivoli*), Amiternum. (*Vitorino*), and Mount Soracte, was moderately hard. The Tiburtine or Travertine stone is a calcareous rock; and it appears that it was employed in constructing most of the buildings of antient Rome. The quarries in Umbria and Picenum furnished a white stone which could be cut with a saw, and would stand well in situations where it was sheltered from the weather, but was liable to be destroyed by rain or frost. On the other hand, the red stone obtained from the quarries about the Vulsinian Lake (*Bolsena*) on the borders of Tarquinii would stand both frost and fire, and would last for ages; on which account it was generally employed for sculptured works. After the destruction of Rome by fire, in the time of Nero, the houses are said to have been rebuilt of the Alban and Gabian stone, which has the property of resisting the action of that element. The quarries of Carrara, on the north-western slope of the Apennines, have long been celebrated for the fine white marble which is so much employed in the north of Europe for statuary.

The British Isles abound with stone of nearly every different kind that can be employed with advantage in architecture. The quarries of Aberdeenshire are said to supply London annually with 12,000 tons of the best granite, which is employed in that city for bridges, river walls, and every work where strength and durability are most required. The Peterhead granite from the same county takes a beautiful polish, and is frequently employed for columns, chimney-pieces, and other ornamental works. The Grampian Hills in Scotland, the quarries in the county of Dublin, and those of Newry in the county of Down, in Ireland, also produce several varieties of the like material. In England granite is obtained chiefly, and in great abundance, from the quarries in Cornwall, where that material is usually designated Moor-stone. Granite from Aberdeen, from Cornwall, and Devonshire was employed in the construction of the present embankment along the Thames above Westminster-bridge.

Sandstone, both red and white, is obtained in large quantities for the purposes of building, from Yorkshire, Lancashire, and Derbyshire; and the principal edifices in Shrewsbury have been constructed chiefly of the white kind which is furnished by the quarries near Grinshill in Shropshire. A millstone-grit, which is now much used in England, is suppled from Bramley and Hedon in Yorkshire. The red-sandstone is dug from the quarries at Barra, Tranent, and other places in Lothian; from those at Kingudie in Perthshire, and also from Arbroath in Forfarshire. In Ireland it is obtained from the quarries in Tipperary and the county of Cork.

A slate-stone for covering buildings and other purposes is excavated from the Denyhall quarries near Camelford in Cornwall, and from those on the Berwyn range of mountains in Denbighshire. Large slate-quarries have been opened near Bangor in Caernarvonshire, and in the Cumbrian Mountains. Slate-stone is also obtained from excavations near Horsham in Sussex; and there are some quarries of this stone in the counties of Donegal and Kerry.

The stone which may be considered as the most extensively diffused over England and Ireland is that which is denominated limestone, and which, from the facility it affords for working it, is most generally called freestone. It is quarried to some extent in Gloucestershire, Shropshire, Derbyshire, and Oxfordshire, and a grey species is obtained in Yorkshire and Northamptonshire; but the principal quarries of this material are in Dorsetshire and in the country about Bath. Those in Dorsetshire are situated about Kingston in the Isle of Portland, and at Swanwich, or Swanage, in the Isle of Purbeck. The most extensive quarries about Bath are at Combe Down, where the ground has been undermined for several miles. More than 30,000 tons of Portland stone are said to be exported annually to London, where it has been very generally employed from the time that Inigo Jones used it in the construction of the Banqueting-house at Whitehall. It was also extensively used by Sir Christopher Wren in the building of St. Paul's cathedral, the Monument, and most of the public edifices in the city after the great fire which occurred in 1666. It is said however to be not so much used at present as formerly. The stone obtained from Purbeck is of various kinds; some of it, which is capable of taking a good polish, has been used for the pillars of Salisbury and Canterbury cathedrals. It is of a darker colour than Portland stone, and in general it is not so good; the blocks raised from the quarries are also smaller. The material is frequently used as a flag-stone for the steps of buildings and for paving the streets. The hills containing the stone lie in a direction nearly east and west; the beds have a considerable dip or inclination to the horizon, and being covered by a large mass of earth, the men work in quarries under ground. About 40,000 tons of this stone are said to be exported annually.

The stone of Portland and Purbeck constitutes the upper oolite formation of the geologists; and in the former district the quarries are cut through several different beds. The first, or that immediately below the vegetable earth, consists of a cream-coloured limestone, three or four feet deep; and next to it is the *cap-stone*, which is of the same colour, very hard, and about ten feet thick. Below these is a species of rock composed of fragments of oyster-shells cemented together, and still lower is a bed, 5 feet thick, of good white stone. This is followed by a quantity of flint about six feet deep, a second bed of good stone five feet deep, and a thin layer of stones of small value. The best building-stone lies still deeper, and the beds of it vary in thickness from seven to fourteen feet. Underneath all these are masses of flints, extending to the depth of fifty or sixty feet. The best oolite of Purbeck is obtained from the quarry of Wardspit in that district.

The quarries near Bath furnish the stone which bears the name of that town, and which is considered by geologists as belonging to the lower oolite formation. It occurs generally in three beds, of variable thicknesses and different qualities. That in the middle is far superior to those which are above and below it. The depth of the middle bed is in some places as much as thirty feet, and the stone when first taken from the quarry is soft, but it becomes hard after having been for a time exposed to the air. The depth of the upper bed varies from twenty to above fifty feet, and the material is either shelly or argillaceous; that of the former kind appears to have been employed by the Romans for the edifices which they constructed in this part of the country, and it is said to be very durable.

The marble and limestone quarries which were opened near Plymouth in 1812 furnished the material which was used in the formation of the Breakwater at that place; and the stone is stated to have been raised from thence in blocks weighing from one to above five tons. The material selected for the construction of the houses of parliament, now in the course of being built, is an excellent magnesian limestone which abounds in all the tract of country from Durham to Northampton; and that which is actually employed is obtained from several different quarries, principally those near Norfall and Anston in Yorkshire, and near Bolsover in Derbyshire.

Limestone is found in Scotland, where it is occasionally employed for architectural purposes. It is also plentiful in many parts of Ireland; and quarries of this material, of a rich kind, have been opened in Queen's County, and in the counties of Dublin, Meath, and Cork. The limestone district of Kilkenny is famous for its quarries of black marble so much used for ornamental purposes, and good flagstones for paving are obtained at Shawhill in the same county.

The quarries in the Cotswold Hills in Gloucestershire afford in abundance a blue claystone for building; and the best stones for pavements are obtained from those at Ealand or Eland near Halifax in Yorkshire. The quarries near Maidstone, on the south bank of the Medway, produce much of what is called ragstone, a material which is occasionally used in Kent for building, but chiefly in the construction of sea-walls and for paving the roads. Lastly, about Ryegate and Godstone in Surrey is found a soft stone which has the property of withstanding the action of fire, and which, on that account, is much used for chimneys, ovens, and furnaces, but it is scarcely fit for any other purpose.

A valuable table of the principal quarries of sandstone and limestone in England accompanies the 'Report concerning the Qualities of Stone with reference to the New Houses of Parliament' (1839).

QUARRYING, the operation of extracting from the ground, or detaching from the sides of rocks, marble, stone, or other minerals, in considerable masses; generally also this operation is accompanied by a reduction of the masses to rectangular forms.

When the material to be excavated lies vertically below the surface of the ground, the work commences by removing the earth to a depth sufficient to lay that material bare, in order that it may be separated into blocks, and removed; but when the stone, &c. is in the interior, and near the side of a mountain or hill, the workmen proceed as in the operation of mining, running galleries into the ground, and leaving pillars of the material for the support of the mass above them.

A quarry of small extent is opened by sinking vertically in the ground a shaft, into which the men descend by ladders; and the blocks of stone, being separated from the mass, are drawn up by means of cranes, which are worked by a windlass or other machine. In working the larger quarries, the vegetable mould forming the upper surface is removed by the spade; and the beds immediately underneath, generally consisting of rag, or stone of an inferior quality, are broken up by gunpowder or otherwise, and conveyed to a distance. The stones intended for sale, and which are generally in beds much below the surface, are sometimes also detached from the mass by blasting [Mining]; but as by this process the blocks are broken irregularly and the stone wasted, a different method is generally employed. The large mass of stone, as it exists in the quarry, consists of strata contiguous to one another, and the surfaces in contact form planes of *cleavage;* in lines parallel to which the stones being more easily divided than in any other direction, these lines constitute what is called the *cleaving* grain of the material. In order therefore to separate a large block from the mass, a series of iron wedges, placed in line a few inches asunder, on the natural face of the rock and in the direction of the cleaving grain, are driven into the stone till a part is loosened: a channel is then cut in the direction of the length of the intended block, and at a distance from the natural edge of the stone equal to its required breadth; and wedges being planted in the channel, they are driven by repeated strokes till the stone is split in that direction also. In the hardest stones, the wedges are placed not in the channels, but in what are called *pool* holes sunk in the direction in which the block is to be severed from the mass. A similar operation is then performed in the direction of the breadth of the block; and thus a large portion is detached from the original mass. (Gwilt, *Rudiments of Architecture.*)

The natural strata of the stone in different quarries are in different positions; frequently they are horizontal, but generally they are inclined to that plane, and sometimes they are vertical: occasionally also both the first and last of these positions are assumed by the stone in the same quarry. It is evident that the separation of the blocks from a mass must be most easily effected when the natural strata are in vertical positions; cutting the stone in directions perpendicular to the line of the grain is always a work of difficulty, and the operations are attended with some danger to the quarry-men when the latter are obliged to work in galleries under ground.

After the blocks have been severed from the mass, they are reduced as nearly as possible to a rectangular form; and this is done by means of a tool called a *kevel*, pointed at one end and flat at the other, with which the irregular parts are knocked off. The blocks are then usually, by means of cranes which are capable of being moved from place to place, raised upon trucks or low carriages; and these are drawn, generally on iron railways, to the quays or wharfs where the stone is put on ship-board. At the slate-quarries in Caernarvonshire the slabs are placed on sledges, which, by an engine, are drawn up an inclined plane; and, from the summit of this plane, the stone is drawn by horses to the Menai.

Vitruvius (lib. x., cap. 6) mentions with approbation the following contrivance, which he says was invented by Metagenes, for conveying from the quarry the shafts of the columns and the stones intended to be employed for the architrave in the portico of the temple of Diana at Ephesus. The ground between the quarry and the temple being too soft to allow such masses of stone to be brought up by ordinary wheel-carriages, the architect or engineer covered each extremity of the block of stone with a frame of timber, from the middle of which projected a short axle of iron; this being received in a gudgeon at the centre of a broad cylinder or wheel placed at each end of the frame containing the stone, and oxen being harnessed to the frame, the stone was thus drawn up to the building. Vitruvius also describes an unsuccessful attempt which was made by an engineer named Paconius to bring from a quarry a mass of stone containing about 576 cubic feet. For this purpose, two broad cylinders of wood, 15 feet in diameter, were constructed; and the stone, being raised from the ground, was made to rest between them, the line of its length being in a horizontal position in the direction of their common axis· then a rope being wound round the circumference of the united cylinders in the middle of the length of the latter, and one end of it being made fast to the harness of the oxen, it was intended that, by the motion of the animals, the cylinder should revolve on the ground, and the stone be brought up to its place. The contrivance appears to have failed, but had the oxen been attached to the two ends of the cylinder instead of its middle, there is no reason to doubt that it would have succeeded.

It is right to observe that builders generally consider it advantageous to dispose the stones in the lower part of an edifice in the same position as they had when lying in the quarry; it being understood that they are then best capable of supporting the weight of the superstructure.

QUART, the same word as quarter, but always used (in our language) for the quarter of a gallon. [Gallon.]

QUARTER, the fourth part of anything. The frequency of division into four parts has caused the word to be used sometimes in the sense of a part or portion allotted. Thus the portion of a camp or barrack allotted to one soldier is called his *quarters*.

QUARTER-SQUARES. A table of the fourth part of the squares of numbers may be substituted for one of logarithms in multiplication. For since

$$\frac{(a+b)^2}{4} - \frac{(a-b)^2}{4} = ab,$$

a table which gives the squares of the halves of numbers will, by the addition of the squares of the halves or quarter-squares, give the product. Such a table has been published in France, and is introduced to a certain extent in the late Professor Leslie's 'Philosophy of Arithmetic.'

QUARTER. [Heraldry.]

QUARTILE, a term of astrology and antient astronomy. Two bodies are said to have a quartile aspect when their longitudes differ by 90 degrees, or one quarter of the whole great circle.

QUARTZ, the mineralogical name of numerous varieties of rock crystal, the native oxide of silicium [Silicium], called also siliceous or flint earth, and silicic acid. It is remarked by Mr. Brooke (*Ency. Metrop.*, 'Mineralogy'), that 'the differences of structure, hardness, specific gravity, mixture with foreign matter, and other characters belonging to this species, are so numerous as to render any single description inapplicable to all its varieties.' Some of the varieties of quartz have been already described; these we shall presently refer to.

Quartz occurs crystallized and massive, and in both states it is widely diffused throughout nature, and is especially one of the constituents of granitic and the older rocks. The primary form of the crystal is a rhomboid, but this is of rare occurrence; it is generally met with in hexagonal prisms terminated by hexagonal pyramids, and when the prism is entirely wanting and both pyramids are present, the crystal is a dodecahedron with triangular planes. Cleavage parallel to the planes and pyramids of the ordinary crystal. Fracture conchoidal. Hardness 7·0. Scratches glass readily, and gives fire with steel. Becomes positively electrical by friction, and two pieces, when rubbed together, become luminous in the dark. Transparent, translucent, opaque. Lustre vitreous, resinous. Specific gravity 2·69 to 2·81. Colourless when pure, but exhibiting a vast variety of colours, of which those mentioned below are the more remarkable.

Quartz is infusible, insoluble in acids in general, but acted on by hydrofluoric acid. It combines by fusion with the alkalis potash and soda, and thus with them acts the part of an acid, and also in many natural compounds; the acid is termed *silicic acid*, and its compounds *silicates*.

The finest specimens of crystallized quartz occur in Dauphiné, Madagascar, &c.; they are found also in Cornwall and near Bristol, of great brilliancy, and are known by the name of Cornish and Bristol diamonds. To enumerate the different places in which this substance occurs would be almost endless. Quartz is composed of one equivalent of silicium = 8, and one equivalent of oxygen = 8; its equivalent is therefore 16.

Hornstone and *Chert* are varieties of compact quartz. Cavernous quartz is termed *Spongiform quartz* or *Swimming stone*, and other scarlet varieties have also been described.

Quartz possessing different colours has received various names; some of these we shall briefly notice.

Brown or *Smoky Quartz*. This occurs in fine crystals near Cairngorm in Aberdeenshire. It is used for seals and ornaments when cut and polished. The nature of the colouring matter is not known, but is probably carbonaceous matter.

Purple Quartz, or *Amethyst*, is found both crystallized and massive. It is of every shade of purplish violet, and the colour in the perfect amethyst is pretty equal throughout the crystal or mass; frequently however the summits of the crystals only are coloured. It is used for ornaments.

According to Rose, amethyst consists of

Silica . .	97·50
Alumina . .	0·25
Oxide of iron .	0·75
	98·50

Amethysts of the finest quality are found in India, Ceylon, Persia, and Siberia. Amethystine quartz of inferior quality is met with in most countries. In Cornwall it occurs in some tin-mines.

Blue Quartz, Siderite, occurs crystallized and massive. It is compact, of a greyish or greenish blue colour. Lustre resinous, waxy. Translucent on the edges. Found near Salzburg.

Green Quartz, found in Peru, in translucent hexagonal prisms. Opaque massive green quartz is called *prase;* the colour appears to be owing to actinolite. It is found in Saxony. *Chrysoprase* is light-green amorphous quartz: it is coloured by oxide of nickel. Found in Silesia and North America.

Yellow Quartz. Transparent. Is of various shades of yellow. Found in Cornwall, Scotland, Bohemia, &c. It is probably coloured by oxide of iron. It has been called Scottish and Bohemian topaz.

Yellow Quartz. Opaque. Ferruginous quartz. Occurs of various shades of yellow and reddish yellow. According to Bucholz, contains 5 per cent. of oxide of iron, to which its colour is owing. Found near Bristol, in Scotland, &c.

Red Quartz, Compostella Hyacinthine Quartz. Colour yellowish or reddish brown. Found in Spain and North America.

Amorphous Quartz. The following varieties of quartz, some of which are intermixed with other substances, have been already mentioned under their respective letters:—Agate, Avanturine, Flint, Flinty Slate, and Opal. There remain to be noticed

Chalcedony and its varieties. This form of quartz occurs amorphous, botryoidal, stalactitical, reniform, and nodular, but never crystallized: it is frequently met with coating quartz, and occasionally in pseudomorphous cubes. It is of various shades of white, grey, yellow, brown, green, and blue, and the colour is for the most part uniform. It is commonly semi transparent. Fracture even, sometimes flat-conchoidal. Infusible. Harder than flint. Specific gravity about 2·6.

Chalcedony occurs in most parts of the earth, especially in Iceland and the Faröe Islands, in Ceylon, India, Siberia, Hungary, &c. Trevascus mine in Cornwall has yielded splendid stalactitic specimens; and Pednanrae mine, in the same county, has furnished it of a blue colour.

The following substances have been considered as varieties of chalcedony:—

Heliotrope. Of a dark green colour, spotted with red (Bloodstone). The specific gravity is 2·6. It is found in Silesia, Iceland, &c.; also in the Isle of Rum, Scotland.

Onyx is composed of flat layers or bands of chalcedony of different colours, more especially brown and white. It is the variety especially used for cameos.

Plasma is of a dark green colour, with yellow and whitish dots; it is transparent, and has a glistening lustre. Its specific gravity is 2·04. It is said to occur in Hungary and in Moravia.

Sard is of a brownish yellow colour. Said to be found in Sardinia.

Sardonyx consists of sard and alternate layers of onyx or white chalcedony.

In addition to these, which may be considered as among the purer varieties of quartz, it occurs mixed with variously coloured clays and other extraneous matter, forming different kinds of

Jasper. This occurs opaque, which constitutes one of the most prominent differences between it and agate. Its colours are green, yellow, and red of various shades, rarely blue; these colours are occasionally mixed in spots and irregular veins. Jasper is massive, has often a resinous lustre, but is sometimes dull. It is found on many parts of the Continent, in Cornwall, and in Scotland.

Striped or *Ribbon Jasper* presents green, yellow, and red colours of various shades, sometimes in spots; but the most beautiful variety is composed of equal and parallel stripes of these colours. It occurs in Siberia, the Harz, and Saxony.

Egyptian Jasper, or *Egyptian Pebble*. This occurs in rough roundish masses, and is generally of a brown colour. Internally it is usually of a light colour. It found on the surface to the eastward of Grand Cairo, and on the borders of the Red Sea.

It is well known that siliceous earth assumes other forms besides that of quartz and the varieties of it which have now been described; one of the most useful of these is common sand; and for the important purposes to which silica in its various states is applied we refer to Silicium.

QUA'SSIA, a name formed in remembrance of a negro named Quassy, who first made known the medicinal virtues of one of the species, is a genus of plants belonging to the Simarubaceous order. Linnæus referred to it several other species, but the most recent botanical writers confine the genus to one, the original source of the bitter drug now commonly sold in Europe. For general purposes it will be most convenient to consider the genus in the same way as Linnæus.

It consists then of trees inhabiting the tropical parts of South America, particularly Surinam and the adjoining countries. They have leaves pinnated like those of the common ash, flowers with a small 5-parted calyx, 5 petals, a definite number of hypogynous stamens, and a fruit consisting of five dry or fleshy drupes.

Quassia amara, the true Quassia of modern botanists, is a small tree, with its leaflets in two pairs, with an odd one, and a winged jointed leafstalk. Its flowers are scarlet, large like those of the red American Horsechesnut, and arranged in narrow racemes. It inhabits the woods of Surinam, Demerara, and probably the greater part of Central America. The wood of the root of this plant was formerly in great repute as a stomachic and as a remedy for the malignant endemic fevers of Surinam. The flowers also were and still are, in that country, infused in wine or spirits, and form a bitter beverage, but the wood is out of use, in consequence partly of its being less easily procured than that of the next species, and partly from an opinion being entertained of some bad properties existing in connection with the intense bitter.

Quassia excelsa, the *Picræna excelsa* of Lindley, is a large tree inhabiting Jamaica. It has oblong, acuminate, obtuse leaflets, in from four to eight pairs, and panicled, corymbose, small pale yellowish-green flowers. This tree yields the Quassia *chips* now so extensively employed in Europe as a bitter substance. The wood is imported from Jamaica in billets of various sizes, is white, scentless, but most intensely bitter. It is one of the ingredients employed by fraudulent brewers in adulterating beer.

Quassia Simaruba, the *Simaruba amara* of Aublet, is the plant which furnishes the *bark* called Simarouba, which comes from Jamaica in bales, and is used as a tonic, although it also appears to act as an emetic. It is a large tree, found in the West India Islands and on the mainland of America. Its leaflets are two to nine on each side, oval, smooth, firm, and sharp-pointed. The flowers are very small, whitish, and arranged in branching scattered panicles.

The three genera, *Quassia, Picræna*, and *Simaruba*, may be distinguished thus:—

Quassia. Petals forming a tube. Stamens 10. Flowers hermaphrodite. Ovaries 5.

Picræna. Petals quite distinct. Stamens 5. Flowers polygamous. Ovaries 3.

Simaruba. Petals quite distinct. Stamens 10. Flowers unisexual. Ovaries 5.

QUA'SSIA. The wood of two different trees is known in commerce by this name: one, formerly very common, but now extremely rare, is obtained from the Quassia amara (Linn., f. supp. 235, and Woodv., t. 77), a native of Surinam, Guayana, &c.; the other, Picræna excelsa, Lindley (Quassia excelsa, Swartz), is a native of Jamaica. Both kinds are imported in billets, sometimes a foot in diameter and several feet long; but before being used for medicinal purposes, they are cut into chips, which are of a light grey colour, or, by long exposure to the air, of a yellow or brownish hue. The physical characters of the two sorts are so similar, that it is difficult to distinguish them; but a watery infusion of the Surinam Quassia by permuriate of iron is only rendered turbid, with greyish flocculent pieces floating in it, while that of the Jamaica Quassia is rendered black by the same re-agent. Both are devoid of odour, but possess an intensely bitter taste, which is stronger but more disagreeable in the Jamaica Quassia. This property at once distinguishes Quassia from any other wood which may be substituted for it. The active principle seems to be *quassite*, a neutral body, which crystallizes in white prisms, and is readily soluble in alcohol. It has a poisonous influence over many of the lower animals, and perhaps even over very susceptible individuals of a higher grade.

Quassia is regarded as a pure and simple bitter, possessing tonic properties of a very marked kind; and hence it is useful in many forms of debility, particularly of the stomach and muscular system. It is generally given in the form of infusion, which serves as a convenient vehicle for some of the preparations of iron, especially the protosulphate and the phosphate. The Jamaica Quassia ought not to be employed as a vehicle for the permuriate of iron, as an inky fluid, instead of a clear transparent one, is the result. The want of aroma may be obviated by adding to the infusion a portion of the compound tincture of Quassia (*Pharm. Edin.*), which renders it more grateful and more beneficial.

Infusion of Quassia, sweetened with sugar, is useful to destroy flies, and is much safer than the fly-waters made of king's yellow or orpiment, a poisonous compound of arsenic: for should children or others drink the infusion, improved appetite would be the only result, whereas death is the frequent consequence of drinking the arsenical fly-water.

QUATRE VALLE'ES, LES, a district in the department of Hautes Pyrénées, comprehending the four valleys (whence the name) of Aure, Barousse, Magnoac, and Neste. The air of the district is cold but healthy; the land is chiefly pasturage or woodland. The woods yield timber for the builder and shipwright. Castelnau de Magnoac was accounted the chief place. The district anciently belonged to the county of Armagnac, a subdivision of Gascogne. [ARMAGNAC; GUYENNE AND GASCOGNE.]

QUEBEC, the capital city and seat of government of the province* of Lower Canada, is situated on the river St. Lawrence, about 400 miles from its mouth, in 46° 49′ N. lat. and 71° 12′ W. long. The population is 27,562.

Jacques Cartier touched at Quebec in 1534, and found an Indian village there. The country was neglected by the French for more than half a century, and it was not until the year 1608 that Samuel de Champlain founded the city of Quebec. An English force under Sir David Kirke captured the place in 1629, but it was restored to France in 1632.

In 1759 a squadron under Admiral Saunders conveyed 8000 troops commanded by General Wolfe to besiege Quebec. They landed on the [illegible]nd of Orleans near Quebec, on the 27th of June, and commenced their attacks on the French lines on the side of Montmorenci; but the dispositions of the French troops made by the Marquis de Montcalm were so skilful that all their efforts proved unavailing, and Wolfe in his dispatches expressed a doubt whether he could reduce the place in that campaign. He resolved however to endeavour to effect a landing above Quebec, which was performed in the night, and on the 13th of September the British army appeared drawn up on the plains of Abraham. The French sallied forth to meet them, and after a bloody battle, in which both armies lost their commanders, the English were victorious. Quebec capitulated on the 18th, and, with the rest of the French possessions in North America, was finally ceded to Great Britain at the peace of Paris in 1763. In 1775, during the American revolutionary war, Generals Montgomery and Arnold attempted to carry Quebec by assault on the night of the 31st of December, but were repulsed, and Montgomery fell.

Quebec is situated on a promontory formed by the confluence of the river St. Charles with the St. Lawrence, at the north-east extremity of an elevated but narrow tableland, which for about eight miles forms the left bank of the St. Lawrence. Cape Diamond presents a nearly precipitous face to the St. Lawrence; the descent to the St. Charles is more gradual. The height of the platform of the citadel of Quebec, which stands on Cape Diamond, is 333 feet 3 inches above the St. Lawrence. The distance from one river to the other across the ridge is rather more than a mile. The St. Lawrence abreast of the town is only 1314 yards wide below the point, the basin is above 1⅓ miles in width, and the tide rises 25 feet. Quebec is situated at that part of the river where the St. Lawrence suddenly contracts in breadth, and is said to take its name from the Indian word *kebec*, which signifies 'narrow.'

Quebec is divided into the upper and lower towns: the lower town, which is the seat of commerce, is built round the base of the promontory, where in many places the rock has been removed to make way for the houses, which are ill built and irregular, and the streets narrow and badly paved. The Custom-house and Exchange reading-room, where all newspapers and periodicals are taken in, and which possesses an extensive library, are in the lower town. The ascent to the upper town is either by a narrow and steep winding street, or by a flight of steps. The upper town has a northerly aspect, and is well ventilated; the streets are rather narrow, but tolerably well paved. All public buildings and many private houses are roofed with tin or iron, which retain their brightness many years, and produce a very striking effect. The citadel which crowns the summit of Cape Diamond is strongly fortified, and covers about 40 acres of ground. A wall, mounted with heavy ordnance surrounds the upper town, which has five gates strongly defended. The citadel contains a very extensive armoury. The Château of St. Louis, the residence of the governor-general, was accidentally burnt during the winter of 1834-5. The Protestant cathedral is a plain modern edifice with a spire; the court-house is close to it. The parliament-house, which was formerly the palace of the bishops of Quebec, stands over the gate leading from the lower town; it is the only public building which has any pretensions to elegance. The Catholic cathedral is a large building with a heavy dome and spire. In the market-place stands the Jesuits' college, now a barrack, a very spacious building, said to be capable of accommodating 2000 soldiers. There are three nunneries, the Ursuline, Hôtel Dieu, and Hôpital Général. The Quebec library contains above 6000 volumes of valuable and standard works. The garrison also possesses a good library. There are a Literary and Historical Society, incorporated by royal charter in 1829; there are also a Committee of Trade, benevolent and friendly societies, a Royal institution, a classical school instituted in 1836, Bible and Missionary societies, and a Mechanics' Institute established in 1830.

In 1832 there were 78 free schools in Lower Canada under the Board of Royal Institution, incorporated for the advancement of learning by the Provincial Act, 4 Geo. III., c. 17, of which board the bishop is the principal. To this board the legislature made an annual grant for the support of these schools. The act providing for the support of these schools, not having been renewed by the provincial legislature, expired May 1, 1836, and the schools have consequently ceased for want of funds. There is a grammar-school at Quebec supported by an annual allowance of 200*l.*, and 90*l.* for a house, from the revenues of the Jesuits' estates. This is under the same board. The mode of instruction is that followed in the grammar-schools in England. The Lancasterian method has been adopted in a few schools. There are several Roman Catholic schools.

Quebec is the seat of a Protestant and a Roman Catholic bishop. The cathedral, which is used likewise as a parish church, will contain about 1600 persons: there is a chapel within the walls, also one in St. John's suburb, one in St. Roche, and one in Wolfe's Cove. There are two Scotch churches and two Dissenting chapels in Quebec. The clergy are supported by salaries from the Society for the Propagation of the Gospel in foreign parts, and one-seventh of the lands in the townships. The Catholic church is richly endowed with lands and tithes. There are a chief justice and three judges of the Court of Queen's Bench, from whence an appeal lies to a court composed of the governor, executive council, chief justice, or any five of them, excluding the judge from whose judgment appeal is made.

The corporation of the Trinity House was established by act of the Provincial Parliament. (45 Geo. III., c. 12.) The following are the rates of pilotage between Bic and Quebec, a distance of 160 miles, for every foot of water which the vessel draws:—

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* By the Act 3 & 4 Vic., c 35, the two provinces of Upper and Lower Canada are reunited.

	Bic to Quebec, per foot. £	s.	d.	Quebec to Bic, per foot. £	s.	d.
From April 2 to 30	1	0	6	0	18	3
„ May 1 to November 10	0	18	0	0	15	9
„ November 11 to 18	1	3	0	1	0	9
„ November 19 to March 1	1	8	0	1	5	9

The winter lasts from November to May; during December, January, and February, the thermometer usually ranges from freezing-point to −25° Farenheit. The river is frozen across at Quebec about once in ten years. During summer the range of the thermometer is from 60° to 90°, and the mean of the summer is about 68°.

The following newspapers are published at Quebec:—'The Quebec Gazette' (by authority), weekly, in English and French; 'Neilson's Quebec Gazette,' daily, alternately English and French; 'Quebec Mercury,' three times a week, English; 'Le Canadien,' three times a week, French.

Accounts are kept in Halifax currency, four dollars being equal to one pound. To change currency (Halifax) into sterling, deduct one-tenth.

Value of gold and silver coins current at Quebec, in currency:—

Gold.

	£	s.	d.
Sovereign	1	2	2¾
Moidore	1	10	0
Johannes	4	0	0
Doubloon	3	14	6
*Eagle	2	10	0
Louis d'or	1	4	8
Pistole	0	18	3
40-franc piece	1	16	2

Silver.

	s.	d.
Crown	5	6
Shilling	1	1
Dollar	5	0
French crown	5	6
Six-franc piece	5	6
Pistareen	0	10

The chief circulating medium is in notes of the colonial banks; there is no colonial currency, the coin in circulation being that of the United States, France, and Spain, rated above its real value. The banks established in Quebec are, the Quebec bank, which has notes in circulation to the amount of near 70,000*l.*; a branch of the Montreal bank; a branch of the bank of British North America; and the Quebec savings' bank, established in 1831.

The old English and French weights and measures are in use. Troy weight is used for gold and silver, precious stones, and drugs; avoirdupois for all other articles. The Canada minot, used for all grain, is about one-twentieth larger than the imperial bushel. The English yard is used for all cloths, stuffs, &c., and the Paris foot for measurements of land or length, unless otherwise specially agreed upon.

The gaol of Quebec is capable of containing 54 prisoners in separate cells; and 158 when more than one prisoner is confined in the same cell: the greatest number of prisoners at one time, in 1837, was,—

	Males.	Females.
Whites	113	66
Blacks and Coloured	1	1
	114	67

Number of emigrants landed at Quebec between the years 1830 and 1840:—

Years.	Number.	Years.	Number.
1831	50,254	1836	27,728
1832	51,746	1837	22,343
1833	21,752	1838	3,239
1834	30,935	1839	7,439
1835	12,527		

The emigrants in 1839 were specified as follows:—Males, 3,136; females, 2,332; children under 14 years of age, 1,971.

From whence emigrants came, 1839,—

	Males.
England	1,586
Ireland	5,113
Scotland	485
Newfoundland, West Indies, &c.	255
	7,439

In 1759 Quebec contained between 8000 and 9000 inhabitants. The following table gives the population at a later period:—

	1825. Houses.	1825. Population.	1831. Population.
Upper Town	480	4,163	4,498
Lower Town	549	3,935	4,933
Suburb, St. Roche	1,120	6,273	7,983
„ St. John	843	6,025	6,918
„ St. Lewis	120		1,583
	3,120	20,396	25,916

Value of imports and exports, 1837:—

Imports.

Whence.	Value. £.	s.	d.
Great Britain and Ireland	212,146	5	3
British Colonies—West Indies	93,331	1	1
„ North America	35,251	6	9
„ elsewhere	40,190	13	10
United States, America	7,105	3	3
	388,024	8	2

Exports.

Whither.	Value. £.	s.	d.
Great Britain	686,817	18	4
British Colonies—West Indies	35,385	17	4
„ North America	84,082	3	7
Foreign States	705	0	0
	806,990	19	3

Ships, port of Quebec, 1837:—

Inwards.

Country.	Number.	Tons.	Men.
Great Britain	787	269,319	12,605
Colonies	120	15,704	
Foreign	30	8,245	
Total	937	293,268	12,605

Outwards.

Country.	Number.	Tons.	Men.
Great Britain	913	312,757	13,323
Colonies	136	9,767	
Foreign	1	353	16
Total	1050	322,877	13,339

Shipping, port of Quebec, from year 1832:—

Inwards.

Year.	Number.	Tons.	Men.
1832	947	261,945	11,414
1833	941	216,[illegible]	10,876
1834	1,091	296,[illegible]	12,828
1835	1,105	311,490	13,425
1836	1,146	341,206	13,415
1837	937	293,268	12,605

Outwards.

Year.	Number.	Tons.	Men.
1832	1007	262,845	11,832
1833	969	248,933	10,910
1834	1124	298,860	12,907
1835	1144	315,974	13,614
1836	1226	347,393	14,869
1837	1050	322,877	13,339

(M'Gregor's *British America; Parliamentary Papers relating to Affairs of Canada; Statistical Returns* made by Board of Trade.)

QUEDLINBURG was the territory of an antient abbey founded between 932 and 936, by the German king Henry I.; it was situated between Halberstadt and Anhalt, and was about 42 square miles in extent, with a population of 15,000 inhabitants. The abbess (after 1539, a Protestant) was an estate of the Empire, and had a seat and vote in the bench of prelates of the circle of the Rhine. The abbess enjoyed the nominal sovereignty of the territory, yet most of the rights of sovereignty were exercised by the elector of Saxony, and then by the elector of Brandenburg, afterwards king of Prussia, who in 1697 bought of Saxony, for 300,000 dollars, the dignity of hereditary bailiff, and a claim to the bailliwicks of Lauenburg, Sevekenburg, and Gersdorf. He had a garrison in the town, had the excise and other taxes, received the oath of allegiance, and had a governor to attend to all these matters, who was immediately under the superior boards at Berlin. The abbess however had her exchequer, her consistory, &c. The last abbess, appointed in 1787, was Sophia Albertina, sister of Charles XIII., king of Sweden. On her decease, at the diet of the empire in 1802, the abbey with its territory was secularised, and assigned to the king of Prussia. In 1807 it was added to the kingdom of Westphalia; but in 1814 again taken possession of by Prussia, and annexed to the circle of Aschersleben, in the government of Magdeburg, in the province of Saxony.

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* The eagle coined before 1834 is worth 2*l.* 15*s.*

QUEDLINBURG, the chief town, is situated on the river Bode, which divides it into two parts, the old and new town; besides these two parts, there are three suburbs. This town has a gymnasium, six hospitals, several schools, and eight churches. In the suburb Westendorf, upon a high rock, are the buildings of the antient abbey, with the handsome abbey church, built by Henry I., which contains a library, and the tombs of Henry I. and his queen Matilda. The population of Quedlinburg at the last census in 1837 was 12,903 inhabitants. They have woollen and linen manufactures, very great distilleries and breweries, and carry on a considerable trade in cattle, corn, garden fruit, as well in the products of their distilleries, breweries, &c. Quedlinburg is the birthplace of Klopstock, the author of 'The Messiah,' the 100th anniversary of whose birth was commemorated by a fête on the 2nd of July, 1824. The town is situated in 57° 48′ N. lat. and 11° 7′ E. long., 30 miles south-south-west of Magdeburg, and 10 miles south-south east of Halberstadt.

(Hassel; Stein; Fritsch, *Geschichte des Hochstifts und der Stadt Quedlinburg*, 2 vols., 1829.)

QUEEN. The Saxon *cpen*, which being used to denote *mulier*, *femina*, *conjux*, as well as the most distinguished of women and wives, to whom now it is only appropriated, we are guided at once to the original use of it as betokening the wife or consort of the king. The other use of it, as betokening a sovereign princess, one who reigns in her own right, and possesses all the rights and functions which belong to a male person who has succeeded to the kingly power in a state, is therefore an application of it which was not originally contemplated.

The king's consort has been regarded in all countries as a person of eminent dignity, and has been invested with privileges which have not been allowed to any other married woman. In England she can purchase lands, and take grants from the king her husband; she has separate courts and officers, including an attorney and a solicitor general; she may sue and be sued apart from her husband, have separate goods, and dispose of them by will. She pays no toll, is not subject to amercement, has a share in fines made to the king for certain privileges, which last is called queen's gold. Antiently manors belonging to the crown were assigned to her in dower, but now the provision for her is made by a parliamentary grant at the time of marriage. Again, there is thrown over her person a peculiar protection. It is as much treason to compass or imagine the death of the king's consort as of the king himself. To violate or defile her person is also treason, though she be consenting. It has been the usual practice to crown the queen with the same kind of solemnities as are used at the coronation of a king. In the case of Caroline, the consort of King George IV., who was living at the time apart from her husband, this was not done; but her right was most ably argued at the time by Mr. Brougham before the privy-council.

The chief distinction between a queen dowager and the widow of any other person of eminent rank lies in this, that though she marry with a commoner, she does not lose her rank; but no one can marry a queen dowager without special licence from the king.

A queen regnant, or princess who has inherited the sovereign power, differs in no respect from a king as to the political rights vested in the dignity.

QUEEN BEE. [Bee.]

QUEEN CHARLOTTE'S ISLANDS, also called the Archipelago of Santa Cruz, are a group of islands in the Pacific, north of the New Hebrides, between 10° and 12° S. lat. and 165° and 168° E. long. These islands were discovered in 1595 by Mandana, but were not visited until Carteret found them again in 1767. The archipelago consists of five or six islands of moderate extent, and a great number of smaller ones. Some of these islands are surrounded by extensive coral-reefs. The largest is the island of Santa Cruz, called by the natives Nitandi, which is above 20 miles long from east to west, and about half a mile wide. On the north-western shore of it is Travenion Lagoon, a fine round harbour, though small. The other islands are Guerta, Tubua, Lord Howe, Mallicolo, and Volcano: the last has an active volcano. The larger islands and some of the smaller are elevated, and apparently of volcanic origin, but most of the latter are low. They are well wooded, and very populous. They produce the cocoa-nut, the bread-fruit, and all the products of the Friendly Islands and New Hebrides. The inhabitants belong to the race of the Austral negroes, but are less savage than those of New Britain and Papua: they have large canoes. It would seem that there has been a mixture with Malays. They are very good-natured, but inclined to theft. They go almost entirely naked. It was on the island of Mallicolo, called by the French Wanicoro, that La Perouse was wrecked and lost with his crew. [Perouse.]

(Carteret's *Voyage round the World*; Dumont d'Urville, *Voyage autour du Monde*; Krusenstern, *Mémoires*.)

QUEEN CHARLOTTE'S SOUND is the long strait which separates the large island of Quadra and Vancouver from the continent of North America. It is supposed to be nearly 300 miles long, but the southern extremity towards Juan de Fucas strait is imperfectly known. The northern extremity, which was surveyed by Vancouver, lies between 51° and 52° N. lat. and 127° and 128° W. long. The shores of this strait, which in many places is narrow, are high and rocky, and indented with numerous deep inlets: they are overgrown with tall forest-trees. (Vancouver's *Voyage of Discovery to the North Pacific Ocean*, &c.)

QUEEN CHARLOTTE TOWN. [Prince Edward's Island.]

QUEEN'S COLLEGE, CAMBRIDGE, was founded by Margaret of Anjou, consort of King Henry VI., in 1446; and refounded by Elizabeth Widville, consort of King Edward IV., in 1465. King Richard III. gave the college all the forfeited estates of John Vere, earl of Oxford, but the grant was annulled on the accession of King Henry VII., who restored the whole to the earl. The greatest benefactors to the college in later times have been Ferdinando Smythes, a fellow, who gave the sum of 1500*l.* for the use of three bachelors of arts till the time of taking their master's degree, and Mr. Hughes, a vice-president, who bequeathed the residue of his property, amounting to about 2000*l.*, to the college.

The president of Queen's College must be elected by a majority of the whole existing body of fellows on the eighth day after a vacancy, and must be at least a B.D. He must also be possessed of property to the amount of 20*l.* per annum, if he is not a fellow at the time of his election.

There are nineteen foundation fellowships in this college. All the fellows within four years from commencing B.A. must proceed to M.A.; those who are on the ecclesiastical foundation must within two years from M.A. be in holy orders, and within nine years from M.A. proceed to B.D. Only two fellows may remain laymen, who proceed to M.A. like the rest, and within twelve years from M.A. the one must proceed to LL.D. the other to M.D. The vice-president and the five seniors hold their fellowships with property; the others recede from the society when possessed of a real annual income stated in the oath before admission. The five senior divines may hold livings not exceeding 20*l.* per annum, and within twenty miles of Cambridge. On the petition of the society the crown has frequently dispensed with some of the above restrictions. A bye-fellowship was founded in 1694, by D. Edwards. This fellowship is perfectly open, may be held by a layman, and is tenable with any property or preferment, except ecclesiastical to a certain amount.

The scholarships of this college, which were consolidated some years ago, have been again consolidated and augmented by college grants; and it has been agreed by the president and fellows that there shall in future be fifteen scholarships tenable till B.A., two of which shall be 50*l.* a year, two of 40*l.*, and eleven of 15*l.* They are in the appointment of the president and fellows present.

There are also two Stoke's scholarships, of 15*l.* per annum, to be given to chapel-clerks; two Sedgwick's scholarships, average 15*l.* per annum, capable of increase to 20*l.*, but subject also to diminution; sons of poor clergymen to be preferred; and one Clarke's scholarship and librarianship of 15*l.* per annum. Sedgewick's and Clarke's scholarships are in the sole appointment of the president.

Among the eminent persons who have been educated at this society may be reckoned Sir Thomas Smith, afterwards provost of Eton, John Weever, author of the 'Funeral Monuments,' Dr. Thomas Fuller, Bishop Patrick, and Dr. John Wallis, the mathematician. Erasmus, who is said to have studied also at St. Mary Hall, in Oxford, resided for some time in this college. There is a portrait of him in the College Hall. [Erasmus.]

The benefices in the patronage of this college consist of the rectories of Bowbrickhill, in Bucks; Eversden parva, and St. Botolph's Cambridge, in Cambridgeshire; Sandon, in Essex; Seagrave, in Leicestershire; Grimston, Rockland, and South Walsham, in Norfolk; Hickling, in Nottinghamshire; and Newton Toney, in Wilts; with the vicarage of Oakington, in Cambridgeshire.

The statutes have been printed for the use of the society. Copies in manuscript exist in the University library, MS. Baker xxxii., p. 241, and in the British Museum, MS. Cole. vol. xlvii., p. 357. Questions have sometimes arisen on the construction of the statutes of this college, and have been decided by the Lord Chancellor, acting on the behalf of the crown, as visitor. (Jacob's *Reports*, p. 1; Russell's *Reports*, vol. v., p. 64.)

The present number of members of this society is 341.

Queen's College is situated to the west of Catherine Hall, on the banks of the river Cam, and consists of two courts, built of brick. The chapel has been modernised.

(Lysons' *Mag. Brit. Cambr.*, pp. 117, 118; *Camb. Univ. Calendar*, 1840.)

QUEEN'S COLLEGE, OXFORD, was founded in 1340, by Robert Egglesfield, rector of Burgh or Brough, in Westmoreland, and confessor to Philippa, queen of Edward III., for a provost and twelve fellows (since increased to sixteen), to be chosen from the counties of Cumberland and Westmoreland. The founder was himself a native of Cumberland. The church of Brough was appropriated to the college by Pope Clement VI., in 1344. Egglesfield gave his foundation the name of Queen's College, probably implying that the queen had been instrumental in promoting his work, and had taken it under her protection. He died in June, 1349.

Eight fellowships and four scholarships, open to natives of any county or place, and four exhibitions confined to the province of Canterbury, have been since founded in this college, in pursuance of the will of John Michel, Esq., of Richmond, in Surrey, who bequeathed lands in Kent and Berkshire for that purpose.

The following exhibitions have been added by other benefactors:—Six of 60*l.* per annum, by Sir Francis Bridgman, for the counties of Lancaster, Chester, or Wilts; five of 100*l.* per annum, by Lady Elizabeth Hastings, for natives of any counties, coming from certain schools in Yorkshire, Westmoreland, and Cumberland; two of 20*l.* per annum, by Frederick Tylney, Esq., for natives of Hampshire; four of 10*l.* per annum, for natives of Wiltshire and Gloucestershire; two of 40*l.* per annum, founded by Dr. Thomas, bishop of Rochester, for the sons of clergymen of the diocese of Carlisle, and educated at the schools of Carlisle and St. Bees; one of 60*l.* per annum, for natives of Middlesex, by Keane Fitzgerald, Esq., a member of the college; and a few others of small value, appropriated to the probationary scholars.

Among a long series of benefactors to this house, who increased its revenues by money, lands, or church livings, we find the names of John de Hotham, one of the early provosts, Sir John Stanford, Thomas Beaufort duke of Exeter, Cardinal Bainbridge, Archbishop Grindal, the founder of St Bees School in Cumberland. In 1626, Charles I., at the request of his queen, gave the college three rectories and as many vicarages in the county of Southampton.

The patronage of this college upon the old foundation consists of the rectories of Sulhamstead Abbas and Sulhamstead Bannister, with the vicarage of Sparsholt, in Berks; the rectory of Holwell, in Dorsetshire; the vicarage of Chedworth, in Gloucestershire; the vicarage of Bramley, the rectory of Bramshot, the vicarage of Carisbrooke, the rectory of Enham, the curacy of Upton Grey, the vicarage of Godshill with Nighton rectory, the rectory of Hedleigh, the vicarage of Milford with Hurdle, the rectory of Newnham with the chapel of Mapledurwell, the rectory of Oakely, the curacy of Pambar, the vicarage of St. Cross, alias Holy Rood, Southampton, and the rectory of Wey Hill in Hampshire; the rectories of Bletchingdon, Charlton on Otmoor, Hampton Poyle, and South Weston, in Oxfordshire; the vicarage of Newbold Pacey, in Warwickshire; and the vicarage of Burgh or Brough, already named, in Westmoreland.

The patronage on Michel's, or the new foundation, consists of the vicarage of St. Wendron with the chapelry of Helston, in Cornwall; the rectory of Bicknor English, in Gloucestershire; the second portion of Pontesbury, in Shropshire; and the rectory of Upton Scudamore, in Wilts.

The visitor is the archbishop of York.

The present buildings of this college consist of two spacious courts, divided by the hall and chapel, and compose an oblong of three hundred feet in length and two hundred and twenty in breadth.

The foundation stone of the first or south quadrangle was laid by Dr. William Lancaster, then provost, on February 6, 1710; but it was not finished till 1759. In 1733 Queen Caroline gave 1000*l.* towards completing this quadrangle: the design is attributed both to Hawksmoor and Wren. [Hawksmoor.] Over the gate of entrance from the High Street, on the south side, is a statue of Queen Caroline, under a cupola supported by pillars.

The library, on the west side of the north court, was begun in 1692, and the outside finished in 1694. The present chapel, the foundation of which was laid in 1714, was dedicated on All Saints' Day, 1719; it is a hundred feet long by thirty. Besides several windows painted by Van Linge, in 1636, and four older windows, all brought from the former chapel, it has a representation of the Ascension on the ceiling, by Sir James Thornhill, and in the middle window, at the east end, the Holy Family, on glass, by Price.

Among the more eminent persons educated in this college have been Cardinal Beaufort, King Henry V., Bainbridge, cardinal and archbishop of York, Bernard Gilpin, Sir Thomas Overbury, Burton the antiquary, Compton bishop of London, Bishop Nicolson, Gibson bishop of London, Archbishop Potter, Tanner bishop of St. Asaph, Hyde the orientalist, Dr. John Hill, Edmund Halley, Addison, Tickel, Dr. John Hudson; Edward Thwaites and Christopher Rawlinson, the Saxon scholars; Shaw the traveller, the poet Collins, and Dr. Richard Burn, author of the well known works on 'The Office of a Justice of the Peace' and 'Ecclesiastical Law.'

The number of members upon the books of this college, December 31, 1839, was 292.

(Chalmers's *Colleges and Halls of Oxford*, vol. i., p. 88-106; *Oxford Univ. Calendar*, 1840.)

QUEEN'S COUNTY, a county of the province of Leinster in Ireland, bounded on the north-west and north by King's County, on the east by the county of Kildare and a detached portion of King's County, on the south-east by the county of Carlow, on the south by that of Kilkenny, and on the south-west by that of Tipperary. This county is comprehended between 52° 45′ and 53° 13′ N. lat., and between 6° 54′ and 7° 47′ W. long. Its greatest length is from east by south to west by north, from the bank of the river Barrow, opposite the town of Carlow (in Carlow county), to the neighbourhood of Roscrea (in the county of Tipperary), 37 English miles: its greatest breadth, at right angles to the length, is from the neighbourhood of Killeigh, a village in King's County, between Tullamore and Portarlington, to the junction of the three counties, Tipperary, Kilkenny, and Queen's, 33 miles. The area is estimated at 476,181 English acres, or 744 English square miles (*Population Returns*; and *Map of Ireland*, by the Society for the Diffusion of Useful Knowledge): it was given by Dr. Beaufort, in 1792 (*Memoir of a Map of Ireland*), at 378,023 acres, or about 590 square miles; and by Mr. Wakefield, in 1812 (*An Account of Ireland, Statistical and Political*), at 602 square miles. The population, in 1831, was 145,851, giving 196 inhabitants to a square mile, upon the statement of area given in the 'Population Returns.' Among the counties of

Leinster, it is the second in respect of size, the fifth in respect of number of inhabitants, and the eleventh for density of population, being inferior in this respect to all except Kildare. Indeed both in amount and density of population it is inferior to most Irish counties. Maryborough, the capital, is on the road from Dublin by Kildare to Limerick, about 49 or 50 miles in a direct line south-west of Dublin.

Surface, Geological Character, Hydrography, and Communications.—Two principal groups of hills traverse the county. The Slievh Bloom, or Bloom Mountains (part of the range of highlands which separates the basin of the Shannon from the basins of the Barrow and the Suir), occupy the north-western part of the county, and in one part separate it from King's County. Portions of this group, which has its greatest extension from south-west to north-east, are respectively known as Garrinbawn Mountain, the Glendine Mountains, and Capard Mountain. The northern slope of the Slievh Bloom is more fertile than the southern, which is chiefly waste, and covered with heath. These hills have sometimes been called 'the height of Ireland,' from an erroneous supposition that they were the loftiest in the island. They are traversed on the border of the county by a narrow defile, the pass of Glendine, which forms the only communication in this part between this and King's County. The Dysart Hills occupy the south-eastern part of the county, and separate the valley of the Barrow from that of its tributary the Nore. They are situated in the best wooded part of the county, to the picturesque appearance of which they much contribute: they do not form a continuous ridge, but consist chiefly of isolated hills. The rest of the county is flat, or varied only by gentle undulations.

The greater part of the county is included in the limestone district, which overspreads so large a part of Ireland. The Slievh Bloom are composed chiefly of sandstone, and a portion of the Dysart Hills is formed by the coal-measures. The coal-field extends from this county into the adjacent county of Kilkenny, and there are several coal-pits in each. The coal-field occupies a basin in the limestone formation, by which it is surrounded on every side. The coal burns with little flame; but it consumes slowly, and sends out a strong heat: it is excellent fuel for malting, and also for forges and other iron-works, but not well adapted for domestic use. Its price places it above the reach of the poor of the vicinity. Iron, copper, and manganese are found, but not worked: ochre fullers' earth, and potters' clay are also met with: the last is employed in making tiles, garden-pots, and other coarse earthenware. Sandstone of a soft texture, suited for hearth-stones and chimney-pieces, and slates, are quarried. Limestone is quarried in almost every part, and marble in a few places.

The county is for the most part comprehended in the basin of the Barrow; but a small portion on the north and a yet smaller portion on the west side belong to the basin of the Shannon. The Barrow rises in the Slievh Bloom, and has a winding course, first north, and then east, to the border of the county, a little above Portarlington: it then continues its course eastward, forming the northern boundary of the county (which it separates from King's County and Kildare county) until it reaches Monasterevan in Kildare. From Monasterevan the course of the stream is southward, and it forms, except just about the town of Athey (in Kildare county), the eastern boundary to the neighbourhood of Carlow, just below which it quits the county. Its whole course in this county and on the border is about 55 miles: it is navigable from Athy, about 40 miles from its source. It receives several small tributaries on its right (or Queen's County) bank, also several on the left (or King's County, Kildare, and Carlow) bank.

The Nore does not fall into the Barrow till long after it has quitted this county: it rises in the adjacent county of Tipperary, enters Queen's County on the south-western side, not far from Burros-in-Ossory, and flows first north-eastward, then eastward, to Castletown. Below Castletown it turns to the south-east and flows to the border of the county, which, before finally quitting it, it separates for a short distance from Kilkenny county. That part of its course which belongs to this county may be estimated at 28 miles. It receives the Tonnet and several other small tributaries on the left bank.

The Lower or Little Brosna, or Brusna, which joins the Shannon below Banagher, rises just within the western boundary of the county; and the Clodagh, whose waters fall into the Brosna, which also joins the Shannon above Banagher, rises within the northern boundary.

The only lake is Lough Annagh, on the northern border of the county; it does not exceed a mile in length: a stream which flows from it at its south-western extremity joins the Shannon. Bogs are numerous in the central part of the county, between the Slievh Bloom and the Dysart Hills.

A branch of the Grand Canal enters the county at Monasterevan, at its north-eastern corner, and there divides into two branches, one of which runs westward about twelve miles to Mount Mellick; the other, known as the Athy Canal, runs twelve miles southward to Athy, just below which town it joins the Barrow: this latter branch is partly in Kildare county.

Two railways have been projected, which will have part of their course in this county; one from Dublin to Kilkenny, which will follow the right bank of the Barrow, and another from Dublin to Limerick, which will run nearly parallel to the present coach-road.

The principal roads are as follows:—the road from Dublin to Limerick by Kildare and Roscrea crosses the county from north-east to south-west, passing through Monasterevan (Kildare county), Ballybrittas or New Brittas, Maryborough, Mountrath, and Burros-in-Ossory. The road from Dublin by Athy and Cashel to Cork passes through Stradbally, Ballyroan, and Abbeyleix. Other roads are numerous, but of less importance: those to the market-towns are generally well laid out, and in good condition; but some of the cross-roads and those in remote parts are bad.

Soil; Agriculture; State of the Peasantry.—Almost every kind of soil is found in the county, from a very stiff clay to a very light sandy but fertile loam. There are extensive tracts of bog, and a good deal of cold wet ground, especially near the mountains. Mr. MacCulloch, who gives the area of the county at 396,810 acres, states that 335,838 are in cultivation, and 60,972 are uncultivated mountain or bog. (*Statistical Account of the British Empire.*) Considerable part of the waste might be reclaimed with great advantage; but the poverty of the tenantry, and the absence of any material assistance from the landlords, prevent this improvement. The same causes prevent also the draining of a considerable quantity of land which, though under cultivation, is comparatively unproductive for want of this improvement, as well the building of farm-houses and other erections, and making fences and roads, the cost of which is generally left to the tenant. The consequence is, that the farm-houses and out-buildings are insufficient, and are usually out of repair, damp, dirty, and miserable. (*Appendix to first Report of Commissioners for inquiring into the Condition of the Poorer Classes in Ireland; Parliamentary Papers for* 1836, vol. xxxiii., p. 385.)

Some improvements have however been made by the more judicious proprietors. The demesne of one of these (in the barony of Portnehinch) 'exhibits some extremely interesting improvements in reclaiming bog-land, which have been effected under the directions of his steward. These improvements are in every stage of progress, from the cutting of the first ditch through th[illegible]aking and worthless bog, to its conversion into fine productive land. One field, which between four and five years ago was a quaking bog, in which no stock could be put, even in the driest weather, without danger of being mired, is now perfectly sound, and feeds heavy cattle. It produced this year a fine crop of hay. The first crop (turnips) which was taken after the draining was completed, paid the whole expense of the improvement. Another field, which was only drained three years ago, and was previously not worth one shilling per acre, has since produced fine crops of turnips and oats, and after giving this summer three tons of hay to the acre, is now, in October, carrying a large stock of fattening cattle and sheep. The bog-land is intersected at every 40 to 60 feet by deep drains made with stones, from six to ten inches in diameter. The cost of this is about 3*l.* 10*s.* or 4*l.* per acre, and it cost about 2*l.* more for the clay and other condensing materials which are spread upon and ploughed in with the surface-soil of the bog.' (*Report of Commissioners*, as above, p. 386.)

In the baronies of East and West Maryborough, comprehending, between them, considerably above 29,000 Irish plantation acres, or 37,000 English acres, only seventeen persons held farms of more than 100 Irish or 127 English acres: by far the greater number of holdings in the barony of West Maryborough were under 5 Irish or 6½ English acres. The principle of consolidating these small holdings has however been adopted by some of the landlords, and is gaining ground, but not very rapidly. In some other parts of the county (*e.g.* the barony of Portnehinch) the small holdings do not bear so great a proportion to the large ones. The smallest holdings are generally through the county occupied by tenants at will; but farms of 10 Irish (13 English) acres and upwards are usually held on leases which are granted for life or 21 years. The system of 'con-acres' (ground tilled and manured by the farmer, and let for the season to the labourers) is prevalent in the county, though not equally so in all parts of it.

The cottiers, especially those who hold under 'middlemen,' usually pay their rent in labour; but other small tenants usually pay in money, though a part is sometimes taken by the landlord in labour, such as carting, at busy times. The number of 'middle-men' (persons who take land of the proprietor and sub-let it) is diminishing: there are still however many of them, and to such an extent is the practice in some places carried, that frequently three or four 'middle-men' will intervene between the proprietor and the occupier of land. Rents are considered high, especially in the case of small farmers who hold under 'middlemen.'

The prevalent rotation of crops is, on the larger farms, as follows:—first year, potatoes with manure; second, wheat or barley, and third, oats; some persons then lay down the land to grass from two to five years. The small holders know little of rotation of crops; they raise potatoes and corn, either wheat, barley, or oats, alternately. The only artificial grasses cultivated by the small holders are clover and seeds. Some of the larger farmers grow clover, a few vetches, rye-grass, and trefoil: turnips and mangel-wurzel are grown, though not to a great extent, by some of the gentry and large farmers. The cultivation of potatoes has increased: peat or bog-stuff is commonly used as manure. The potatoes grown by the small farmers are 'lumpers,' a coarse but very productive variety.

The harvest is generally got in with care, except that the barley, and sometimes the other crops, are cut late, so as to occasion loss from shedding. It is commonly threshed as soon as cut, for the purpose of paying rent; and is usually sold by the sample: there are good corn-markets at Maryborough and Mount Mellick, at which last-named town much corn is ground into flour for the English and other markets.

Grazing-farms are not numerous, and are generally occupied by gentlemen farmers. The grazing-land is not commonly very good, and the quantity of it has rather decreased. There are no dairy-farms, but each of the large farmers keeps a few cows. The breed of cattle has been much improved, but the subject is not so well understood as in some of the neighbouring counties: the kinds most in request among the larger farmers are the short-horned or Durham, and the Ayrshire, but the small farmers think the native Irish breed is best, as being more accustomed to the food and climate of the country. The d[illegible]y cows most approved are either the native stock of a cross-breed between the native stock and the Durham or the Ayrshire. More cattle are fattened for exportation than formerly; the increase may be attributed to the introduction of steam-navigation as opening a means of communication with England, and to the improvements in rural economy. Little or no cheese is made at present, but a considerable quantity of butter. The increased intercourse with England has led to a great improvement in the making of the butter. The number of sheep kept is considerable, chiefly by the large farmers. This breed is generally large, and has been much improved within the last twenty years; it is a cross between the native Irish breed and the Leicester. The introduction of the Leicester sheep has led to improvement both in the quantity and quality of the fleece and the weight of the carcass. The horses are not kept in proper condition for working; nor is the breed of pigs so good as in some other counties of Leinster. Oxen are not much used for agricultural purposes.

The manures in general use are bog-stuff, animal manure, lime, marl or limestone gravel, and road scrapings. The small farmers have no knowledge of the advantage of stall-feeding over grazing considered as a source of manure. Lime is burned with culm, sometimes with turf; but is not used to the extent to which it might be used. Burning land is very little practised; the landlords generally consider it injurious.

The fences commonly consist of a bank with a ditch, and generally a hedge: but the hedge is usually irregular and insufficient, composed of whitethorn, briar, furze, or brambles, frequently with gaps of several yards in extent. Some of the gentry and large farmers have orchards, of which part of the fruit is sold. The farm-buildings and sheds are generally insufficient, and, among the smaller farmers, usually in bad repair. Modern improved agricultural implements are little used, except the light Scotch plough: threshing-mills, rollers, and winnowing-machines are found only in the yards of resident proprietors or large farmers.

A great number of persons have emigrated of late years, almost exclusively to the United States or to Canada. Many of them were Protestants, and possessed of some little property.

The labouring population very far exceeds the means of employment: of 3401 labourers in the three baronies of East and West Maryborough and Portnehinch, 1104 were constantly employed, 1857 occasionally employed, and 440, from illness, old age, or other causes, were seldom or never employed. Wages are very low; for constant labourers about 6*d.* a day with 'diet,' *i.e.* breakfast and dinner; 8*d.* or 10*d.* and in some cases 1*s.* a-day without diet: in hay-time and harvest the wages are occasionally as high as 1*s.* 6*d.* or even 2*s.* and 2*s.* 6*d.* In the colliery districts the colliers, according to the nature of their work, receive from 1*s.* 2*d.* to 2*s.* 2*d.* a day. The 'diet' given by farmers to their labourers consists chiefly of potatoes and milk, sometimes 'stirabout,' or oatmeal porridge; some of the wealthier and more liberal occupiers add meat on Sundays and holidays. The labourers are not considered equal to the English in steadiness and skill; this inferiority may be partly ascribed to bad and insufficient food. Great distress prevails among the labourers from the beginning of June till harvest, so that the wretched peasantry are at times obliged to boil the charlock or wild mustard to eke out a miserable subsistence; and in years of scarcity or failure of the potato crop the distress extends upward to the small occupiers. The labourers live on the land of their employers, and usually have some land with their cabins: they pay their rent in labour: for a cabin alone they pay 1*l.* to 2*l.*; for a cabin which an acre of land (usually the worst on the whole farm) 3*l.* to 4*l.*: some proprietors allow their labourers more land (sometimes as much as six acres) for about the same rent that would have been charged to a farmer. The number of these 'cottiers,' or labourers who work regularly for a master under whom they rent their cabins, is in some parts of the county fast diminishing. The cabin is frequently built and almost always repaired by the labourer.

There is little employment for women or for children under the age for going out to service. What little work is done by women is chiefly by the labourers' grown up daughters or other unmarried women, or by married women who have no family. Children above 14 or 16 sometimes get employment at 5*d.* a-day without diet, or 3*d.* a-day with it. There is rather more employment for women at some busy seasons, as harvest and potato setting and digging. Most labourers' wives keep fowls, by which they earn a trifle. The labourer usually keeps a pig.

Potatoes form the principal food of the labourers, and those chiefly of the coarsest sort called 'lumpers.' Meat, eggs, and fish are rarely enjoyed even by the small farmers, by the labourers never. The cabins of the peasantry are generally of clay and straw; some have a foundation of stones, and a few are entirely of stones; most of them consist of two apartments, a living room occupying two-thirds of the cabin, and a small chamber. There is never an upper story, and the roof is of sod covered with thatch; they are altogether miserable habitations, except the few belonging to the gentry and larger farmers, and occupied by their labourers. Many have no windows; others have only an unglazed opening, blocked up in cold or wet weather with straw or by a shutter, and some have glazed windows of all sizes. The general fuel is turf. The dress of the peasantry is generally wretched; the children, especially the boys, are half-naked, and go barefoot; the women and elder girls, through the cheapness of materials, are enabled to dress a little better; and the wives and daughters of the more comfortable labourers wear shoes and stockings. The furniture of the cabins and the supply of bedding is commonly wretched, and in the poorer cabins the inmates sometimes sleep on straw, hay, or rushes. In some parts of the county the cabins are altogether more comfortable and better furnished. Those round Mountmelleck, inhabited by persons connected with the trading or manufacturing establishments of that town, are of superior character. Drinking is, or was lately, rather on the increase; the drunkards are chiefly of the class of small tradesmen.

Divisions, Towns, &c.—The county is divided into nine baronies, as follows:—

Name.		Situation.		Population in 1831.
Ballyadams	.	E.	.	8,954
Cullinagh	.	S.	.	15,447
Maryborough (East)		Central.	.	10,931
Maryborough (West)		do.	.	16,725
Portnehinch	.	N.E.	.	15,382
Slieumargy	.	S.E.	.	15,804
Stradbally	.	E.	.	8,328
Tinnehinch	.	N.W.	.	17,113
Upper Ossory	.	W. & S.W.		37,167
				145,851

We have no authorities which give the areas of the repective baronies; but it may be stated that Upper Ossory is probably twice as large as any other; and that of the rest, Portnehinch, West Maryborough, Cullinagh, and Tinnehinch are the largest; Slieumargy has probably the most crowded population, a pre-eminence which may be ascribed to the mining district which is comprehended within it.

The assize town is Maryborough: there are one parliamentary borough, Portarlington; five market and post towns, viz. Abbeyleix, Ballinakill, Mountmellick, Mountrath, and Stradbally; and five post-towns which have no market, viz. Ballybrittas, Ballyroan, Burros in-Ossory, Clonaslee, and Rothdowney. Graigue is a suburb of Carlow. The largest villages are Arles, Ballylinan, Castletown, and Emo.

Maryborough is in a central situation, in the barony of East Maryborough. It was constituted the assize on the formation of Queen's County, by an act of 3rd and 4th of Philip and Mary, and received its name of Maryborough in honour of that queen. The town consists of several streets, narrow, irregularly laid out, badly paved, and altogether inconvenient; the principal street is on the road from Dublin to Limerick. The number of houses in 1831 was 508, of which 484 were inhabited by 641 families, 10 were uninhabited, and 14 building. Above 200 of these were comfortable houses, the rest were miserable cabins. The principal public buildings are the new county gaol and the lunatic asylum, the last being for the district which comprehends four counties, King's, Queen's, Westmeath, and Longford; a court-house, and rooms adjacent for county business, formed out of part of the old gaol, an infirmary, a handsome range of infantry barracks, a parish church, a large and handsome Catholic chapel, three meeting-houses for Protestants, and a nunnery adjacent to the Catholic chapel. There are some remains of a strong castle which existed at the time when the town was fixed upon for the county town; the remains comprehend a bastion and part of the walls. Near the town are the ruins of the antient church. The lunatic asylum stands in the midst of an enclosed area of above twenty-two acres, handsomely laid out and planted. The building has a front of hewn stone, 365 feet long, and will accommodate from 150 to 160 patients. It had 131 on the 1st of January, 1837. The county gaol is a spacious and well-arranged prison on the radiating plan; the management of it is well spoken of by the inspectors. (*Inspectors' Reports* for 1837.)

Maryborough was incorporated by charter of 12 Eliz. (A.D. 1570). The limits of the borough extend to the distance of 8000 feet from the walls of the castle (which is in the centre of the town), and comprehend an extensive rural district; a new and more contracted boundary has been therefore recommended. (*Reports from Commissioners of Boundaries of Municipal Corporations in Ireland.*) The burgesses were in 1833 reduced to three. The burgomaster is a justice of the peace within the district; but petty-sessions are held weekly by the county magistrates. There is no corporation police, but from 15 to 30 of the county constabulary are usually quartered in the town.

The town has little trade. The market, which is on Thursday, has improved: wheat, which was formerly scarcely brought to it, is now sold in considerable quantity. A branch of the cotton-manufacture, but on a small scale, is carried on. Shoemaking is prosperous. There are eight yearly fairs. The population of the town, in 1831, was 3223; that of the whole parish of Borris, in which the town stands, was 5300. There is neither benefit society nor savings' bank nor house of industry in the parish; but there are forty spirit-shops and one pawnbroker's shop.

The living is a rectory and vicarage, united with the rectory and vicarage of Killcolemanbane and the vicarage of Straboe, all in the diocese of Leighlin, and comprehending altogether a population of about [illegible]700, in 1831, of which about 1200 or 1300 belonged to the established church, while the rest were nearly all Catholics. There was a Roman Catholic chapel at Straboe, in the union, besides that of Maryborough. The net yearly value of the united benefice was returned at *525l. 6s. 2d.* There were, according to the Parliamentary Returns for 1835, ten schools in Maryborough parish, and two in that of Killcolemanbane; twelve in all in the union, with 811 scholars, viz. 445 boys and 366 girls: of these schools, two, both at Maryborough, with 253 boys and 221 girls, were national schools; two were classical schools for boys, with 32 scholars; two were girls' schools of the better sort, with 25 children (four of them little boys); three were connected with religious or charitable societies, with 81 boys and 93 girls; and three were hedge-schools, with 72 boys and 31 girls.

The quarter-sessions for the division, at which the civil business of the borough is transacted, are held here twice a year the county assizes are also held here, and it is the place of election for the county. Maryborough returned two members to the Irish parliament, but was disfranchised at the Union. It gives the title of baron to W. Wellesley Pole, brother of Marquis Wellesley and the duke of Wellington.

Portarlington is on the river Barrow, what separates in this part King's County and Queen's County, in each of which part of the town is situated. It is about forty four miles west-south-west from Dublin, through Naas and Monasterevan, and about twelve miles north-north-east from Maryborough. The part which is in King's County is in the parish of Clonehorke, in the barony of Upper Philipstown; that which is in Queen's County is in Lea parish, in the barony of Portnehinch. The town took its rise in the the time of Charles II., who granted a large extent of country in this part of Ireland to Lord Arlington. The town consists of two principal streets, which meet in an area or square, the centre of which is occupied by one of the two churches or chapels. They are in some parts paved or flagged by private subscription, but are not lighted. Few towns in Ireland present so respectable an appearance, owing to its being the residence of an unusual number of private gentlemen. In 1831, there were in the town 505 houses, of which 486 were inhabited by 579 families, 16 uninhabited, and 3 building: a somewhat later return gives 580 houses, of which 300 are slated and the rest thatched: most of them built of lime and limestone. The population. in 1831, was 3091: a part of the inhabitants are descended from some French and German Protestant refugees settled here by Lord Arlington. There are two bridges and two churches (or more properly chapels), neither of them parochial; those of St. Michael and St. Paul, or, as they are sometimes called, the English and the French, from having been originally appropriated to the use respectively of the English and French settlers. Both the churches were erected by Rouvigny, earl of Galway, to whom the lordship originally held by Lord Arlington had come. The English church has a handsome spire. There is a handsome Roman Catholic chapel, with a spire 140 feet high, and a Methodist chapel. Over the market or town-house there are three rooms, the largest occasionally appropriated to assemblies. There are a small tobacco manufactory, a soap and candle manufactory, and a tan-yard: the rest of the trade of the town is retail. There is a corn and general market held on Wednesday, and a meat-market on Saturday: there are also eight yearly fairs for horned cattle, horses, sheep, and pigs. A branch of the Grand Canal passes near the town. The town was incorporated by charter, A.D. 1667. Courts leet and baron and a court of record are held under the lord of the manor, and petty-sessions are held by the county magistrates. From eight to ten of the county constabulary are generally stationed here. There are no public charities except schools, but there is a very excellent savings'-bank. Public-houses and spirit-shops are very numerous.

Portarlington returns one member to parliament. Before the Union it returned two members to the Irish parliament, but at the Union was reduced to one. By the Irish Reform and Boundary Acts, the franchise was extended, and the limits of the borough defined. The number of voters on the register, in 1834-5, was 156. The living of Lea (in which parish the part of the town which belongs to Queen's County is situated) is a vicarage, of the clear yearly value of 272*l*. (including the value of the glebe), and a glebe-house. There is a small parish church at Lea, and there are the two churches, founded by Lord Galway, in the town of Portarlington. These places of worship have (by the Parliamentary Returns, 1835) congregations amounting in the aggregate to more than 1000 persons. The Roman Catholic chapel had a congregation of 1300, and the Wesleyan of 100. In the whole of the two parishes of Geashill (of which Clonehorke is a dependency) and Lea, there were, according to the returns made to parliament in 1835, thirty five day-schools, containing 1108 boys and 872 girls; and an adult school of 29 scholars: giving a total of thirty-six schools, and of 2009 persons under daily instruction. Five of the schools were in connection with the National Education board; four were partly supported by the London Ladies' Society, or London Hibernian Society; one was connected with the Kildare-place Society; and six were partly supported by private subscription. Of the private schools, one was for adults, three were classical schools for boys, two were girls' schools of a superior kind, three were ordinary day-schools, and eleven were hedge-schools. A loan-fund and a mendicity society have been established, There were also in Geashill parish eleven Sunday-schools for religious instruction, ten of them for Roman Catholics. Portarlington gives the title of earl to the Dawson family.

Abbeyleix is 9 miles south-south-east of Maryborough and 60 south-west from Dublin. The parish is chiefly in the barony of Cullinagh, but partly in that of West Maryborough, and partly in that of Fassadining, in the county of Kilkenny; the town is wholly in Cullinagh. Abbeyleix took its origin and name from a Cistercian Abbey in the territory of Leix, now Queen's County. The town is neatly built, the late Lord de Vesci having caused the old town to be entirely razed, and laid out the present one on a more eligible site. The number of houses in 1831, was 141, viz. 126 inhabited by 178 families, 10 building, and 5 uninhabited. There are a good market-house, a sessions-house, where the quarter-sessions for the division are held twice in the year, and a new bridewell. The population, in 1831, was 1009 for the town, and for the entire parish 5990. A considerable woollen manufacture is carried on: about two hundred persons are employed in combing, spinning, and weaving. There is a weekly market (on Saturday) and six yearly fairs Freestone, limestone for burning, and potters' earth are procured in the neighbourhood. Abbey Leix, the seat of Lord de Vesci, surrounded by a demesne of more than 1100 acres, and thriving plantations, is near the town. The area of the parish is 11,974 acres. There are in the parish two parish churches, one rarely used: the other, a handsome modern building of Gothic architecture, with a tall spire, has a congregation of five hundred: there are a Roman Catholic chapel, with a congregation of two thousand, and a Wesleyan meeting-house, with a congregation of seventy. The living is a vicarage: the net value of the benefice (including a small glebe) is about 138*l*. There were, by the returns of 1835, six day-schools, with 203 boys and 151 girls; together 354 children: two of the schools are private schools, three are partly or wholly supported by subscription, and one is partly supported by the London Hibernian School Society and by local subscription. There are some almshouses, and a dispensary and infirmary.

Ballinakill is in Dysart Gallen or Galon parish, in the barony of Cullinagh, 13 miles south-south-east of Maryborough, and 64 south-west from Dublin. The town is in a bye-situation, and in a declining state; the streets are neither paved nor lighted. The number of houses, in 1831, was 360, viz. 335 inhabited by 346 families, 4 building, and 21 uninhabited: the population was 1927 for the town, or 4014 for the entire parish. The manufacture of woollens, though declined from what it formerly was, is still carried on, and there is a brewery. Formerly two markets were held weekly, but the Wednesday market has been long disused, and the Saturday market has been injured within the last few years by the establishment of that of Abbeyleix on the same day. Ballinakill was incorporated by James I., and returned two members to the Irish parliament, but the franchise was lost at the Union, and the corporation has since fallen into disuse. Quarter-sessions and petty-sessions were once held here, but have been removed to Abbeyleix. A body of the county constabulary are posted in the town. The parish of Dysart Gallen, or Dysert Galon, contains 10,557 acres. The parish church, a small modern building with tower and spire, is in Ballinakill; it has a congregation of from 150 to 250 persons. There are two Roman Catholic chapels, one in the town, and another in the rural part of the parish; they have congregations of nearly 4000. There were in the parish, by the Returns of 1835, nine schools with 429 boys and 407 girls; together 836 children. Of the nine schools, the two largest (containing 594 children) were connected with the National Board of Education; two were partly supported by subscription or other extraneous sources; the other five were hedge-schools.

Mountmellick is on the Owenass, one of the feeders of the Barrow, 7 miles north by west of Maryborough, and 51 miles west-south-west of Dublin. It stands chiefly in the parish of Rosenallis, in the barony of Tinnehinch, but a small part of it is in the parish of Coolbanager, in the barony of Portnehinch. The whole town had, in 1831, 710 houses; of which 687 were inhabited by 805 families, 15 were uninhabited, and 8 were building. There is one principal street; several of the houses are very neat and even elegant, and the town may be regarded as the most important and prosperous in the county. Cotton-weaving and coarse woollen-weaving are carried on to a considerable extent, and furnish employment to from 3000 to 4000 people in and round the town. There are an iron and brass foundry for the manufacture of machinery, a tan-yard, breweries, soap-houses, potteries, a distillery, and a corn-mill. A branch from the Grand Canal at Monasterevan to the town has tended greatly to increase its trade in corn, butter, and general merchandise. There are two weekly markets, and ten yearly fairs. A body of the county constabulary are stationed in the town: the quarter-sessions for the division are held here twice in the year. There is a chapel-of ease in the town, in the parish of Rosenallis, which has a congregation of 350 persons; the two parish churches of Rosenallis and Coolbanagher (or rather, of Ardea, a parish united with Coolbanagher) are at a distance from the town. There were in the two parishes, in 1835, four Roman Catholic chapels, with aggregate congregations of 4000; four meeting-houses or other places of worship for Wesleyans, with congregations amounting to 350 persons, and one Quakers' meeting-house with a congregation of 140: we know not which of these places are in the town. There were at the same time twenty-six day-schools; viz. seven in connection with the National Board; ten connected with the London Hibernian Society, the London Ladies' Hibernian Society, the Kildare-place Society, or supported by subscription, or by Erasmus Smith's fund; a Quakers' boarding-school, five private day-schools, and three hedge-schools: in these schools there were 1627 children, viz. 930 boys and 697 girls. There were also in Rosenallis two large Sunday-schools, kept by the vicar and the curate.

Mountrath is in the parish of Clonenagh, in the barony of West Maryborough, 8 miles west-south-west of Maryborough, and 60 west-south-west of Dublin, on the great road to Limerick. The foundation of the town was laid early in the seventeenth century, by Sir Charles Coote, who, in 1628, obtained a grant of two fairs and two markets, and established a linen and fustian manufactory. The Rebellion of 1641 interrupted the rising prosperity of the town. In 1831 it contained 442 houses, of which 420 were inhabited by 448 families, 13 were uninhabited, and 9 were building. The population at the same time was 2593. There are a respectable market-house, and a court-house and bridewell lately erected. The church is a handsome building; and there are a large Roman Catholic chapel, a convent of the order of St. Patrick, and a Bridgetine nunnery. The Methodists and Quakers have also meeting-houses. Calico and stuffs are woven, and there are a large brewery, a malthouse, and an oil-mill. There is a considerable weekly market for corn and butter; there are six yearly fairs. The quarter-sessions for the division are held here twice in the year; and there are petty-sessions held weekly. Ballyfinn House, the splendid seat of Sir C. H. Coote, is in a beautiful and well-wooded desmesne near the town. There were in the whole parish in 1835, nineteen schools, viz. nine national schools, four schools partly supported by subscription, two convent schools, a classical day and boarding school, two private day-schools, and a hedge-school. The two convent schools are attached to the Bridgetine nunnery in the town of Mountrath; one is for the education of children of the higher order, the other for the poor; the classical school is superintended by monks of the order of St. Patrick, who have a convent in the town. There is a large school-house in the town, erected chiefly through the liberality of Sir C. H. Coote; but by which of the above-mentioned schools it is occupied does not appear. The total number of children in the schools at the time of the return was 1780, viz. 1037 males and 743 females. There is a dispensary in the town.

Stradbally is in the parish and barony of Stradbally, 7 miles east of Maryborough, and 48 south-west of Dublin, on the road by Athy and Cashel to Cork. Antiently there was a Franciscan monastery here. The town, which is on a small feeder of the Barrow, in a pleasant situation, had, in 1831, 306 houses, viz. 296 inhabited by 331 families, 8 uninhabited, and 2 building. The principal street is spacious, the houses well built, and there is a bridge of three arches over the stream. The church is a handsome building. Near the town are Stradbally Hall and Brockley park, two mansions with their demesnes. The market is on Saturday, and there are five yearly fairs. There is a station of the county constabulary in the town. The quarter-sessions for the division are held here twice in the year, in a neat court-house with a small bridewell attached; and there are petty sessions every fortnight. There are a dispensary, a savings' bank, and a large Catholic chapel. There were in 1835, in the parish, seven schools, viz. two boarding-schools, three day-schools, two of them on the system of the Kildare-place Society, a hedge-school, and a national school.

Ballybrittas is in Lea parish, in the barony of Portnehinch, 9 miles north-east from Maryborough, and 42 south-west of Dublin. It is a neat place, of pleasing appearance, containing 27 houses, inhabited by 31 families, and 1 house building. Three fairs are held in the year. A body of constabulary are posted here, and there are petty-sessions once a fortnight. Ballyroan is in Ballyroan parish, in the barony of Cullinagh; 58 miles from Dublin on the road by Athy and Cashel to Cork. The place had, in 1831, 132 houses inhabited by 133 families, forming a population of 714. There is a station of the constabulary. There are three fairs. There are a neat plain church, a spacious Roman Catholic chapel, and a good school-house for an endowed classical and English school on Alderman Preston's foundation. There were also in 1835, in the parish, two day-schools, partly supported by subscription, and two hedge-schools. Burros in Ossory, in the parish of Aghaboe, in the barony of Upper Ossory, was antiently of considerable importance as a military post, being on the river Nore, and on a site encompassed by bogs. It now consists of one long street, on the road from Dublin to Limerick, 67 or 68 miles from Dublin, and 16 from Maryborough; and comprehends 129 houses, viz. 124 inhabited by 147 families, and 5 uninhabited. There are several fairs in the year. Quarter-sessions for the division are held here twice in the year, and petty-sessions at irregular intervals; there are a bridewell, a station of the county constabulary, and a dispensary. Clonaslee is in the barony of Tinnehinch, remote from any great thoroughfare, 9 miles west-north-west of Mountmellick, on the bank of the Burradois or Clodagh, over which there is a good bridge. The village contained in 1831, 79 houses, viz. 78 inhabited by 94 families, and 1 building: the population was 514. There is a parish or district church, also a Roman Catholic chapel. Petty-sessions are held weekly, and there are two fairs in the year. There is a school on Erasmus Smith's foundation, and one if not two national schools. Rathdowney is in the barony of Upper Ossory, 10 miles south-west from Maryborough, remote from any great thoroughfare, on a small stream that flows into the Erkin, a feeder of the Nore. The town contained in 1831, 211 houses, viz. 195 inhabited by 240 families, 11 uninhabited, and 5 building. The population was 1214. The houses are generally ill built and neglected, and the streets are ill paved. Petty-sessions are held in the town weekly, and there are several yearly fairs. There are a parish church, a Roman Catholic chapel, and a Wesleyan meeting-house in the town. There is a parochial school, connected with the Kildare-place Society, and a national school in the town, and a second national school, and several other schools in different parts of the parish. There are in the parish the remains of three castles, of a church and burial-place, of a church and monastery, and of a very antient cross.

Graigue is in the parish of Killeshin, in the barony of Slieumargue. It is close upon the border of the county, and forms a suburb of the town of Carlow, with which it is connected by a bridge over the Barrow. It contained in 1831 324 houses; of which 305 were inhabited by 382 families, 13 were uninhabited, and 6 were building: the population was 1976. There are two tan-yards, a flour-mill, and a distillery. The parish church is a handsome building; there is a very large Roman Catholic chapel. There are a national school and a station of the county constabulary.

Arles or Arless is a neat village in the parish of Killeban and barony of Slieumargue, about 7 miles north-west of Carlow. It contains about 40 houses and 205 inhabitants. There is a small manufacture of linen and yarn carried on; the manufacture of tiles for roofing has been brought almost to nothing by the increased use of slates. Ballylinan is also in the parish of Killeban, but in the barony of Ballyadams. It has a police station, several fairs in the year, and petty-sessions weekly. It contained in 1831, 94 houses, viz. 89 inhabited by 103 families, 4 uninhabited, and 1 building: the population was 533. There are the ruins of an old church in the village. Castletown, in the barony of Upper Ossory, about 2½ miles from Mountrath, takes its name from an old castle on the banks of the Nore. The village is also on that river: it contained, in 1831, 59 houses, many of them good residences, with a Roman Catholic chapel, and is altogether a place of neat and respectable appearance. Of the houses 52 were inhabited by 60 families, 4 were uninhabited, and 3 were building: the population was 376. There are large flour and oatmeal mills. There is a yearly fair, and petty-sessions are held every fortnight. A body of the county constabulary are posted here. Emo, in the barony of Portnehinch, 7 miles north-north-east of Maryborough, and 3 or 4 south of Portarlington, had, in 1831, only 14 houses inhabited by 17 families, and a population of 102: but it has a neat Roman Catholic chapel, a public school, and a constabulary station. Adjacent to it is Emo park, the seat of the earl of Portarlington.

Divisions for Ecclesiastical and Legal Purposes.—This county was formed of portions of the districts previously known as Leix and Ossory; the latter comprehending all that part of the county which is to the south and west of the Nore; the former including all the rest. The county was formed at the same time that the adjacent district of Ofally was made shire-ground. The two were named respectively Queen's County and King's County, in honour of Mary and her husband Philip of Spain, and their capitals were named after the same royal personages, Maryborough and Philipstown.

The county is comprehended in the dioceses of Leighlin and Ossory (now united) and Kildare. The parishes in the six baronies of Ballyadams, Cullinagh, Maryborough (East and West), Stradbally, and Slieumargue, are in Leighlin, except one parish in Ballyadams barony, which is in the diocese of Dublin; those in the barony of Upper Ossory are in the diocese of Ossory, except one, which is in the diocese of Killaloe; those in the baronies of Portnehinch and Tinnehinch are in Kildare. All these dioceses are now in the ecclesiastical province of Dublin. Killaloe was in that of Cashel before the union of that province with the province of Dublin.

Queen's County is included in the home circuit: the assizes are held at Maryborough, and quarter-sessions for the divisions of the county are held at Maryborough, Mountmellick, Mountrath, Stradbally, Burros-in-Ossory, and Abbeyleix, twice in the year at each of these places. The number of persons committed for trial at the assizes and quarter-sessions in 1837 was 301; the number tried at petty-sessions and before magistrates, 418; together, 719: being considerably below the average of the counties of Ireland in the number of assize and quarter-sessions cases, as well as in the whole number of criminals, but exceeding the average in the number of cases disposed of at petty-sessions and before magistrates.

The county gaol is at Maryborough, and is well conducted, especially as it respects the male prisoners. There are three minor prisons, namely, at Abbeyleix, Burros-in-Ossory, and Stradbally, which are now remarkably well kept, clean, and regular. They are visited by the governor of the county gaol under the direction of the Board of Superintendence.

The county returns to parliament two members, who are elected at Maryborough. Portarlington returns one member. Before the Union the county sent altogether eight members to the Irish parliament, namely, two county members, and two each for the boroughs of Maryborough, Portarlington, and Ballinakill. At the Union, Maryborough and Ballinakill were quite disfranchised, and Portarlington lost one member. The number of county electors qualified in 1834-5 was 1692, of whom 1427 voted at the contested election of that time.

On January 1, 1836, the constabulary force of the county included one magistrate, 4 chief constables or sub-inspectors of the first class, and 6 of the second class, 49 constables, and 274 sub-constables, with 15 horses. On January 1, 1838, this force comprehended one sub-inspector, 4 chief constables of the first rate and 4 of the second rate; 1 head constable of the first class and 9 of the second class; 37 constables; 230 sub-constables of the first class and 46 of the second. The whole expenditure on this force for the year preceding January 1, 1838, was 14,327*l.* 14*s.* 3*d.* The total amount of the grand-jury presentments for that year was 19,566*l.* 16*s.*, namely: for new roads, repairs, bridges and roads, 4638*l.* 4*s.* 1*d.*; for building, repairs, and rent of session-houses, 427*l.* 2*s.*; for building new gaol, 923*l.* 1*s.* 6½*d.*; for gaol and bridewell expenses, 2270*l.* 6*s.* 3*d.*; for public and county officers' salaries, 2123*l.* 15*s.* 6*d.*; for the police establishment, 4467*l.* 16*s.* 6½*d.*; for the administration of justice, 480*l.* 1*s.* 8*d.*; for deserted children and malicious injury to property, 388*l.* 13*s.* 7*d.*; for the infirmary and dispensaries, 1528*l.* 14*s.* 9*d.*; for building lunatic asylum, 462*l.* 5*s.* 6½*d.*; for the support of the lunatic asylum, 587*l.* 9*s.* 2*d.*; for miscellaneous, printing, &c., 1269*l.* 5*s.* 4½*d.* There are in the county a district lunatic asylum for Queen's County, King's County, Longford, and Westmeath; and an infirmary (both at Maryborough); a dispensary and fever hospital united; and eleven dispensaries.

The number of schools in the county connected with the National Board of Education in 1835 was 40, with 43 teachers and 5263 scholars.

History, Antiquities, &c.—Of the inhabitants of this county, in the earliest period of Irish history, nothing certain is known. At a somewhat later period the county was comprehended in the districts of Leix and Ossory. Ossory, which was originally a kingdom dependent on the greater kingdom of Leinster, was subjugated and annexed to Munster, still however preserving its separate organization as a kingdom. The chieftain or king of Ossory, one of the Macgillypatrick or Fitzpatrick race, stoutly resisted the Anglo-Norman invaders of Ireland in the twelfth century, and attacked Leix, which was then under Dermod, king of Leinster, who had called in the English. He subsequently however made his peace with the English, and managed to retain his independence. The adjacent district of Leix was included in the English pale, and was formed into a county palatine, which passed into the hands of the Mortimers, lords of Wigmore. In the reign of Edward II., O'More, an Irish chieftain, to whom Mortimer had entrusted the administration of his domain, became so powerful as to hold it in his own right, and to be a very troublesome opponent to the English in that part of the pale, and for two centuries the district was the seat of almost incessant war between the O'Mores and the English. It was either just previous to or during this unsettled period (in 1315, or rather 1316) that it was invaded by Edward Bruce and his confederates, who burned the castle of Ley near Portarlington, and a small burgh or town which had grown up under its protection. The district of Leix appears to have continued in a state of precarious independence till the reign of Henry VIII. Ossory also maintained at this time its independence, but its chiefs were usually in alliance with the English. In the reign of Henry VIII. this part of Ireland was again the scene of contest between the governors, Gerald, earl of Kildare (A.D. 1514), and afterwards Thomas Howard, earl of Surrey (A.D. 1521), and the sept or clan of O'More, but the struggle produced no decisive result. But on the death of Henry VIII., the O'Mores having again rebelled in conjunction with the O'Connors of Ofally (now King's County), were defeated by Sir Edward Bellingham, the lord deputy, who sent their chiefs prisoners to London (where O'More died), and re-annexed their territories to the English pale. A new rebellion in these two districts in the reign of Mary was quelled with a severity which threatened to extirpate the inhabitants, and the districts were, by act of parliament, converted into shires. In the latter part of the reign of Elizabeth, the O'Mores were again in rebellion, in consequence of which the county was invaded by the lord-deputy, the earl of Essex (A.D. 1599), who broke the power of the rebellious clan: their ruin was completed by Lord Mountjoy, the successor of Essex.

In the rebellion of 1641, Roger More, head of the now reduced sept of the O'Mores, acted a conspicuous part, and was in fact the mainspring of the rebellion. The insurgents attempted to seize several places in this county: Maryborough and the castle of Ballinakill fell into their hands, as well as Shane or Sion Castle near Coolbanagher, and other places of strength. They besieged the castle of Burros-in-Ossory, but the garrison, consisting of Protestants of Upper Ossory, held out until relieved by Sir Charles Coote (A.D. 1642), who had been detached by the duke of Ormond, then posted with the government army at Maryborough. Shane Castle was retaken by the same officer. On the retreat of Ormond, the insurgents under Preston again overran the county, and Ballinakill, which had been taken from them or given up by them, was again besieged by their troops, but relieved by Colonel Monk: in 1643, it was a third time besieged, and, after a vain attempt to relieve it, was forced to surrender. Burros-in-Ossory Castle was also again besieged by the insurgents in 1642, but with what success does not appear: they took however the castle of Lea, or Ley, near Portarlington. In 1646, the insurgent force from Ulster, under Owen Roe O'Nial or O'Neal, occupied Maryborough and several other strongholds; but the Parliamentarians maintained a strong garrison in the castle of Burros-in-Ossory, by a party of which, in 1647, the neighbouring fort of Ballaghmore, held by the insurgents, was taken. The victors, on their way back, were attacked by a party of insurgents, and lost several men. In 1649, Maryborough and some other places were taken from the insurgents under Owen Roe O'Nial, by the Royalists under Ormond, with whom a considerable part of the more moderate insurgents had by this time united themselves. Shortly afterwards these places were taken from the Royalists by the Parliamentarians under Colonels Hewson and Reynolds. In the war which ensued on the Revolution of 1688, some fighting took place in the county, in which the Jacobites were defeated by William's army.

(*Parliamentary Papers*; Lewis's *Topographical Dictionary of Ireland*; Cox's *History of Ireland*; Gordon's *History of Ireland*: *Map of Ireland*, by the Society for the Diffusion of Useful Knowledge.)

QUEENBOROUGH. [KENT.]

QUENTIN, ST., a town in France, capital of an arrondissement in the department of Aisne, situated on the right bank of the river Somme, very near the source of that river, 79 miles in a straight line north-north-east of Paris, or 86 miles by the road through Senlis, Compiègne, Noyon, and Ham; in 49° 51′ N. lat. and 3° 17′ E. long.

St. Quentin appears in the 'Itinerary' of Antoninus, and in the Peutinger Table, under the name of Augusta Veromanduorum, i.e. Augusta of the Veromandui, a nation of the great Belgic stock, inhabiting the country of Vermandois, to which they have given name. The oldest quarter of the town has retained down to modern times the name of Aouste. St. Quentin subsequently became the capital of the county of Vermandois in the government of Picardie. It was the seat of a bishopric, which in the sixth century was transferred to Noyon. In the sixteenth century it was a strongly fortified place, one of the bulwarks of France on the north-eastern frontier. In 1556 it was besieged by a Spanish army of 50,000 men, with an auxiliary corps of 8000 English, all under Emanuel Philibert, duke of Savoy. The small garrison under Coligny, admiral of France and governor of Picardie, made a brave defence, but was obliged to surrender after the complete defeat of a French army, which, under the constable Montmorency, had advanced to relieve the place. It was restored to France at the following peace of Cateau-Cambresis.

The streets of the town are for the most part of good width, lined with well-built houses; the principal streets end in a large square in the middle of the town, in the centre of which square is a deep and very curious well. The town-house, an antient Gothic building, forms one side of the square, and near it is the cathedral, another fine Gothic building, remarkable for its elevation and the boldness of its architecture; the steeple may be seen in clear weather as far off as Laon, a distance of twenty-four miles. The antient fortifications have been converted into promenades and planted with trees. There are three faubourgs.

The population of the commune of St. Quentin in 1826, was 17,661; in 1831, it was 17,686, of whom 17,096 were in the town; in 1836 it was 20,570. The manufactures are the most important of the department. Cotton-weaving and the spinning of cotton-yarn (in which steam is employed) give employment to at least 6000 persons in the town and neighbourhood, one-fourth men, one-half women, and the rest children. The fabrics are of various kinds, dimities, calicoes, quiltings, muslins, gauzes, &c. The bleaching and finishing of the goods give employment to 700 persons more; there are also bleaching-establishments for linen, of which a considerable quantity is manufactured in this part of France; though this branch of industry is by no means equal to what it was before the Revolution. The dyeing of cotton has been introduced of late years; the goods were previously sent to Rouen for that purpose. Silk and Cashmere shawls are woven in the town; and table-linen, and light fancy-goods in silk, cotton, and wool are manufactured. In the manufactures of the district of which the town is the centre, it is computed that more than 100,000 workmen are employed in spinning or weaving; and 30,000 women and children in the auxiliary processes. (Dupin, *Forces Productives, &c. de la France.*) Soft soap, vitriolic acid, leather, and machinery are made. There are steam flour-mills and oil-presses. The commerce of the town is promoted by the good roads by which it is connected with the neighbouring towns; and by the canal of St. Quentin, which, with other canals, connects the navigation of the Somme, the Aisne, and the Schelde. There are fourteen fairs in the year; one of them lasts nine days.

There are a tribunal de commerce, a chamber of manufactures, a subordinate court of justice, and several fiscal government offices. There are a high school, a society of sciences and arts, a public library of 12,000 volumes, a theatre, a free drawing-school; a course of instruction in mechanics and geometry as applied to the arts has been instituted in compliance with the dying exhortation of the late General Foy. The Benedictine D'Achery, and the Jesuit Charlevoix, known by his histories of New France (Canada), St. Domingo, Japan, and Paraguay, were born at St. Quentin.

The arrondissement of St. Quentin is divided into seven cantons or districts, each under a justice of the peace, and 130 communes; it had, in 1826, a population of 106,285; and in 1831, of 110,770.

QUERCITRON BARK, the bark of the *Quercus tinctoria* or *Quercus nigra* of North America, deprived of its brown epidermis. It was first introduced into England by Dr. Bancroft, and is now one of the most important dyeing materials. This bark contains a yellow colouring matter, mixed with much tannin; the colouring principle amounts to about eight per cent., and may be extracted by water; and, according to Chevreul, this colouring-matter may be obtained by gently concentrating the infusion of the bark. It is then deposited as a crystalline matter, which has a pearly appearance as long as it remains suspended in the liquor in which it is formed; Chevreul gives it the name *quercitrin*, but, according to Berzelius, it is not a pure immediate principle. It is stated by the former chemist that quercitrin is slightly acid, as is shown by its restoring the yellow colour of turmeric reddened by lime. It is slightly soluble in æther and more soluble in alcohol. Water dissolves it. The solution is rendered orange-yellow by alkalis; the acetates of lead and copper, and chloride of tin, precipitate it in yellow flocks; sulphate of iron renders it olive-brown, and then precipitates it. Sulphuric acid dissolves quercitrin, and the solution, which is of a greenish-orange colour, is rendered turbid by water. When submitted to dry distillation, quercitrin yields, among other products, a liquid which readily affords yellow crystals of quercitrin unchanged in properties.

The tannin which quercitrin contains is of that variety which gives a green colour with peroxide of iron. Its presence greatly deteriorates the beauty of the yellow colour, because it is precipitated by the same reagents as the colour itself, and gives it a brownish tint. In dye-works therefore the tannin is precipitated by adding a solution of glue to the decoction, in order to precipitate the tannin, and there is thus obtained a more delicate and brilliant yellow, which is afterwards precipitated in combination with alumina or oxide of tin. With the salts of iron quercitrin gives a great variety of olive and drab tints, dependent upon the presence of more or less tannin, and the strength of the decoction employed.

QUERCUS, the Latin word for an 'oak-tree,' which is of frequent occurrence in the Roman writers. It is now, as then, applied to the oak and all the other species associated with it by botanists in one common genus. Quercus differs essentially from Castanea, the chesnut, in having short obtuse stigmata, and from both it and Fagus, the beech, in the cells of its ovary containing two ovules instead of four. It is also distinguished by its acorn or nut being seated in a cup, and not in a close husk; but there are intermediate conditions of this part, technically called the cupule, which render it of less value as a mark of distinction than would at first sight appear. Many of the oaks of the hotter parts of Asia have the acorn completely enclosed within the cupule. Still however the prickly husk of the beech and the chesnut, splitting into valves, may in general be distinguished from the closed-up cup of the Indian oaks.

Oaks, like roses, are scarcely known in a wild state in the southern hemisphere; in the islands of the Indian Archipelago they reach their most southern limits, especially in Java; thence they pass upwards beyond the equinoctial line, and following the eastern parts of Asia, they spread to the westward along the Himalaya Mountains, and reaching Europe, are only arrested by the Atlantic Ocean. On the other hand they find their way to the eastward of their Asiatic origin, and overrun America from Canada and New Albion through California and Mexico, till their progress to the south is stopped by the Isthmus of Darien.

While however the genus is thus extensively distributed, the species are confined within comparatively narrow territorial limits. Many of the Javanese kinds appear to be peculiar to the Indian Archipelago, or only occur near the south-eastern angle of Asia. Those of the Himalayas are perfectly distinct from the oaks of the Trans-Himalayan regions, and have not even been found on the mountains of Persia. Several of the Oriental kinds are known nowhere else, and the American species are quite peculiar to that country.

On this account the species of oak are extremely numerous; probably not fewer than one hundred and fifty; and as always occurs in large genera, they are difficult of distinction by unskilful persons. Nevertheless the universal utility of their timber, and their striking beauty as ornaments of scenery, have caused them to be written upon by persons of little botanical knowledge, and the consequence has been such a confusion and entanglement of the history of even common and well known species, as can only be remedied by a long and patient examination of the genus by a botanist of great practical skill. On the present occasion we can pretend to nothing more than a brief account of those species which are best known, or to which it is most essential that attention should be directed. The reader will find a very elaborate account of the genus in Loudon's *Arboretum Britannicum*, vol. iv., where are wood-cuts of numerous species and an abundance of popular and amusing information.

Although a geographical arrangement of species is not a very scientific mode of treating the subject, we believe it to be the best that we can follow on the present occasion.

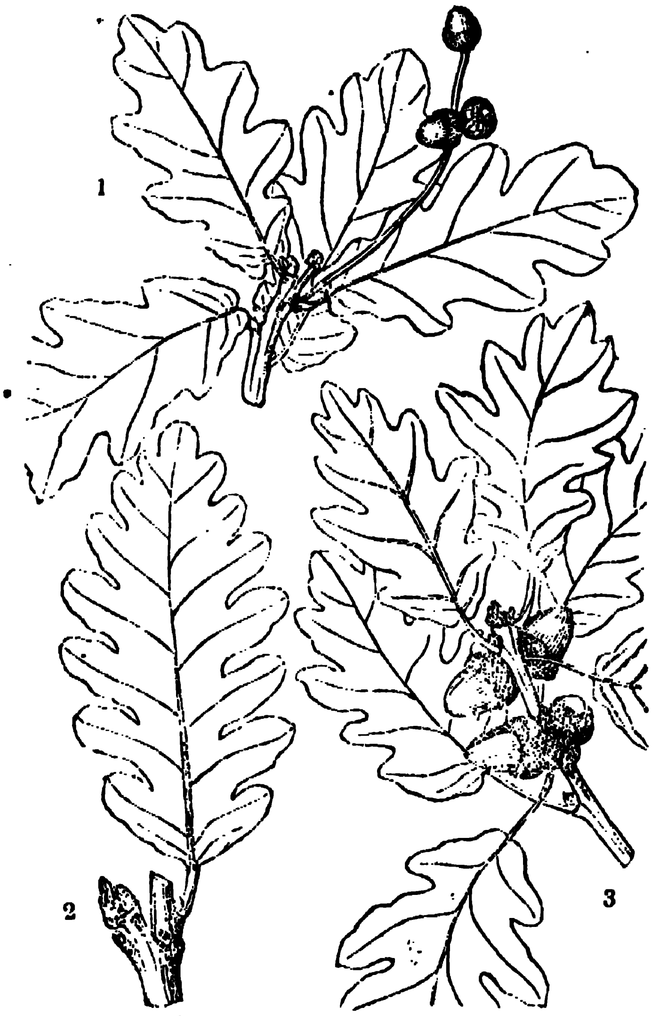
I. *Oaks of Europe, Northern Asia, and Barbary.*

Under this head we include all the more common species of the genus, the greater part of which exist in cultivation in this country. They may be divided into three groups: the *forest oaks*, or *Robora*; the *European oaks* or *Ilices*; and the *Mossy-cupped oaks*, or *Cerres*.

a. The Forest Oaks (ROBORA).

The species comprehended under this head have deciduous thin leaves, whose lobes are never lengthened into a bristle, and whose acorns are seated in shallow cups, the scales of which are so short and closely pressed to the sides as not to form visible extensions. The wild oaks of England may be taken as the representatives of the others, which differ from them chiefly in the quantity of down upon their leaves, the size of the acorns, and the quality of their timber.

Q. Pedunculata, Common British Oak. Leaves sessile or nearly so, with numerous deep sinuosities and a thin texture, with but little polish on the upper side. Acorns arranged in long stalked spikes. This, which is our commonest oak in England at the present day, appears not to be confined to the colder parts of Europe, as has by some been supposed, for we have specimens before us both from Spain and Hungary, but it is certainly much more common in the north than in the south, where its place is usurped by the next species. It has the reputation of being the *true British oak*, whose timber is alone suited for naval purposes on account of its durability and hardness; but this is a mere fable, the wood of the next species being as suitable in all respects under equal circumstances. But the timber of the oak, like all other wood, is materially affected by the nature of the soil in which it grows, and this has probably given rise to the often repeated assertion that Sussex oak, which chiefly consists of *Q. pedunculata*, is the best kind that can be employed in shipbuilding. The species is readily known by its leaves having very short stalks, or none at all, while the acorns are placed on very long stalks. In consequence of the importance of distinguishing it from *Q. sessiliflora*, we have thought it desirable to introduce a wood-cut of the plant, common as it is.



1, Q. pedunculata; 2, Q mannifera; 3, Q. sessiliflora.

The *Q. fastigiata* of the gardens is a singular variety, with the branches rising close to the stem, like those of a Lombardy poplar.

Q. sessiliflora, Sessile-cupped oak. Leaves on long yellowish stalks, with numerous sinuosities, and a firm texture; much polished on the upper side. Acorns either altogether sessile or arranged in very short stalked spikes. We have already stated that the timber of this has been supposed, although erroneously, to be inferior to that of *Q. pedunculata*. Experiments as to strength and toughness have shown that there is no material difference between the two in those respects, and the durability of the wood of the sessile-cupped oak is attested by the well known fact, that the roof of Westminster Hall is constructed of it, and not of chesnut, as has been sometimes said. It has been found to be the timber of some of the most antient buildings in this country and elsewhere; an immense beam in an old Shropshire building, now called Stone House, was *Q. sessiliflora*, and the oak usually obtained from bogs, where it must have lain for centuries, has often proved to be the same.

The wood may be easily known by its medullary rays, or silver grain, being so far apart that it cannot be rent, and this gives it quite a peculiar aspect. *Q. sessiliflora* is found all over England now, but nowhere in much quantity. It however is more abundant in the west than elsewhere, and constitutes the greater part of the oak of North Wales. It is a much handsomer plant than the last, and grows considerably faster, and therefore is by far the most advantageous kind for the planter. Its comparative scarcity at the present day may perhaps have arisen from its having been felled in preference as long as any of it remained in the antient forests, which its superiority in size to the other species would render probable, and not having been replaced, it would thus become gradually exterminated. It appears to be still common over all the south of Europe, where however it is not uncommonly mistaken for the last. The supposed species called *Q. apennina* and *Q. microcarpa* are probably varieties of it. What is called the Durmast oak, which has been regarded as a species by some botanists under the name of *Q. atrovirens*, or *intermedia*, seems to us a slight variety of *Q. sessiliflora*, with the leaves pubescent on the under side. It is here in all probability that the classical Esculus of Virgil belongs, for, according to Professor Tenore, a broad-leaved variety, which he calls *Q. robur Virgiliana*, answers in all respects to the language of the poet, and its acorns are sweet, and eaten like chesnuts at this day in Italy, where they are called *Quercia castagnara*. (*Osserv. sull. Flor. Virgiliana*, p. 12.)

Q. pubescens, a native of the southern parts of Europe, has most of the characters of Q. sessiflora, but its leaves are smaller, often quite woolly on the under side, and the lobes are themselves much sinuated. It has been injudiciously confounded with that species, to which it is said to be in all respects inferior in the quality of its timber. It forms a majestic tree, with much the habit of Q. Cerris.

The *Q. Esculus* of Loudon is, no doubt, the same as the last; but what the plant was to which Linnæus applied the name, and which has been supposed by some to be the Esculus of Virgil, is altogether doubtful. Another oak related to the sessile-cupped is the *Q. pyrenaica*, or *Tauzin*, a small scrubby tree inhabiting poor sandy soil in the south of France, and throwing up an abundance of suckers. Its wood is of little value except for the staves of casks. This species is readily known by its grey leaves, the hair of which is remarkably coarse.

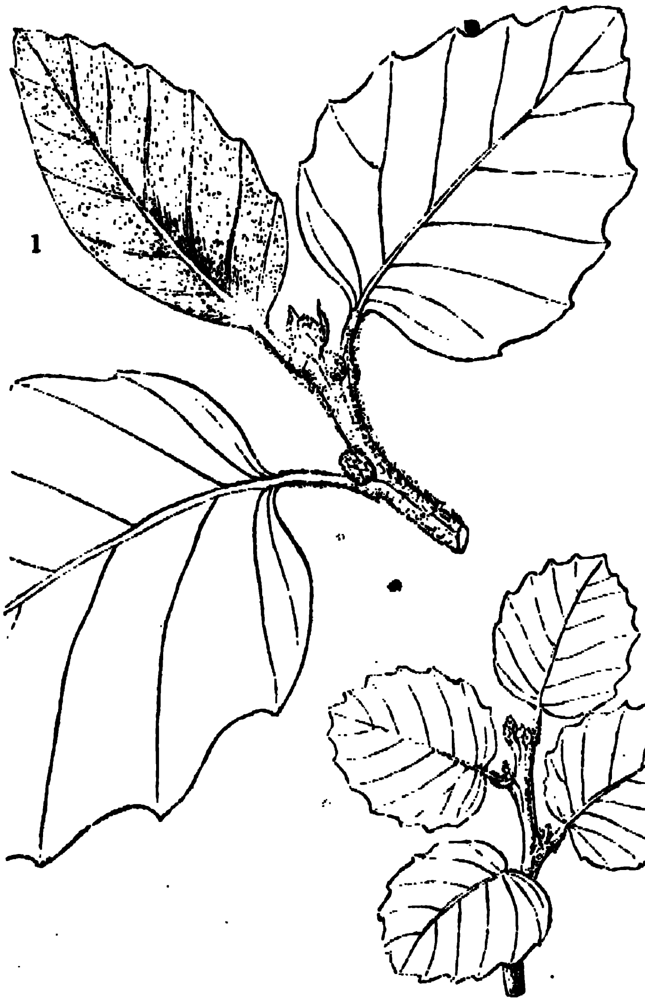
b. The Evergreen Oaks (ILICES).

All the European oaks with leaves truly evergreen belong to this section, which however in some respects approaches the mossy-cupped oaks when the latter acquire a semi-European habit. In such cases they are known by the scales of their cups being very short, and the toothings of the leaves not bristle-pointed.

Q. Ilex, Common Evergreen Oak, or Holm Oak. Leaves ovate-oblong, acute, coriaceous, entire, or serrated, hoary beneath. Bark even. Acorns ovate, on short stalks. A most variable plant, common all over the south of Europe, where it may be found with leaves varying from being as prickly as a holly to being as even at the edge as an olive, and from the size of a sloe-leaf to that of a beech. It loves the neighbourhood of the sea, and in its wild state generally grows singly or in small clusters, not forming forests. Its wood is very hard and heavy, tough, and in all respects of excellent quality, where its weight is not against it. Its acorns are bitter and unfit for food.

Q. Ballota, Sweet-acorn Oak. Leaves elliptical, coriaceous, entire or serrated, very obtuse, white, and downy beneath. Bark even. Acorns cylindrical, elongated. This evergreen oak, says Captain Cooke, is one of the leading vegetable features of nearly all Spain. The native woods are formed of it in a great measure. As a species, it is quite distinct from the Q. Ilex; the leaves are thicker, more rounded at the point, of a dull glaucous green, and the tree is altogether more compact and of a less graceful form. The great and essential difference however is in the acorns, which are eatable, and when in perfection are as good as or superior to a chesnut. To give this sweetness they must be kept, as at first they have a considerable taste of tannin, which however disappears in a few days. These are the edible acorns of the antients, which they believed fattened the tunny-fish on the passage from the ocean to the Mediterranean; a fable only proving that the species grew on the delicious shores and rocks of Andalusia, which unhappily is no longer the case. (Captain Cooke's *Sketches in Spain*, vol. ii., p. 245.) This author says that the name Ballota is from the Spanish *Bellotas*, which means acorns generally. But the Persians have an acorn which they describe under the name of *Shah-bulloot* and *Bulloot-ool-mulik*, and the acorns of Q. incana are sold in Indian bazaars as *Bulloot*, as we learn from Dr. Royle; therefore the name has probably an Eastern origin. This species is the *Q. gramuntia* of Linnæus, and is cultivated in England, but does not bear acorns. We have it also from Algiers. Captain Cooke calls it *Q. Hispanica.*

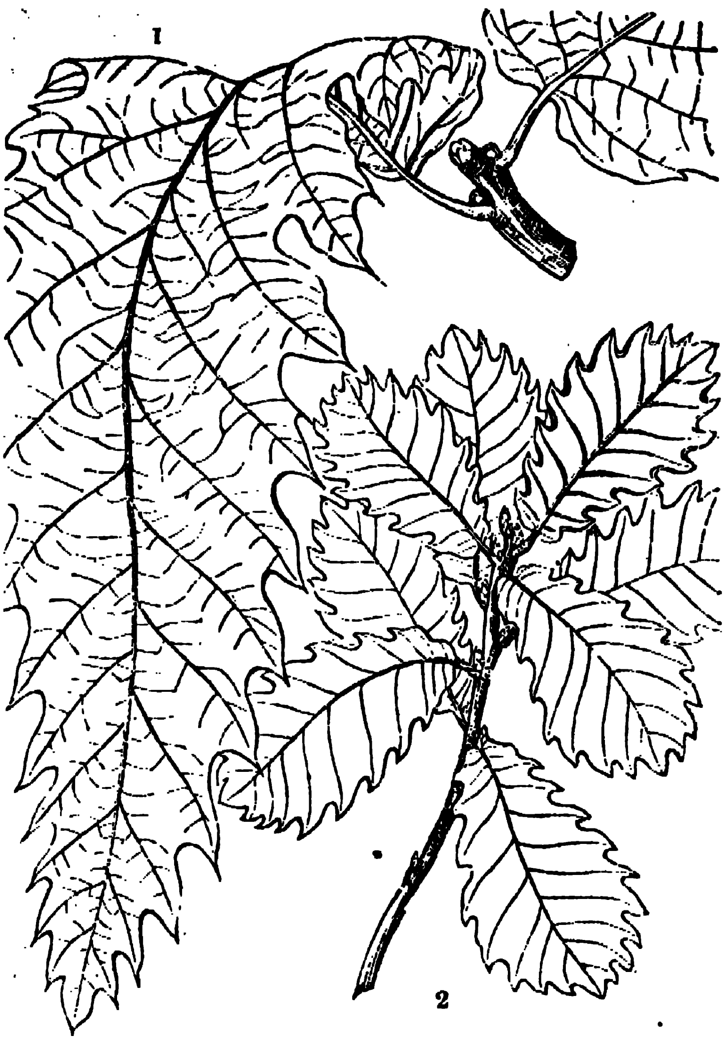
Q. rotundifolia, Round-leaved Oak. Leaves nearly orbicular, with spinous teeth, a little heart-shaped at the base, smoothish above, downy beneath. Very little is known of this plant, except that it is allied to Q. Ilex. Smith and others say it is a Spanish plant, and if so, they probably meant Q. Ballota; but we have before us a Turkish specimen, of which a cut is given, to which the name is very applicable, and which is quite different from that species.



1, Q. Bruntii. 2, Q. rotundifolia.

Q. Suber, Cork-tree. Leaves ovate-oblong, bluntish, coriaceous, entire or sharply serrated, downy beneath. Bark cracked, fungous. The Cork-tree is spread through all the warm parts of Spain, but is most abundant in Catalonia and Valencia, whence the principal exports have been made. In the property of forming a spongy soft substance on its bark, it surpasses all other European trees, and hence is of the greatest value for corks and for similar purposes. The form of the tree is said to be much more beautiful than that of the common evergreen oak, and in the districts suited to it attains a great height. The species bears the climate of London, but acquires little of its natural beauty in this country.

Q. faginea, Beech Oak. Leaves on short stalks, obovate, with numerous uniform shallow lobes; downy beneath; when young somewhat heart-shaped and unequal at the base. Fruit sessile. Cup with downy, close-pressed, somewhat ciliated scales. Acorn conical or somewhat cylindrical. A native of Portugal, Spain, and Tangiers, and apparently unknown in our gardens. Mr. Barker Webb, however, who has studied some of the European species with great care, regards it as identical with Q. Turneri, or Q. australis, and if so, we possess it. The same learned botanist reduces to this the Aleppo gall-nut oak, Q. infectoria, and he is probably right.



1, Q. regia: 2, Q. faginea.

Q. coccifera, Kermes Oak. Leaves elliptic-oblong, rigid, smooth on both sides, with spreading, bristly, spinous teeth. Acorns ovate. Cup with spreading pointed scales. A native of the south-eastern parts of Europe, where it forms a small bush, resembling a dwarf holly. It is celebrated as being the haunt of the Kermes insect, which yields so brilliant and permanent a blood-red dye that the old Flemish tapestries, dyed with it two centuries ago, have lost none of their brilliancy. For the manner of collecting the Kermes, and for many particulars concerning it, see Loudon's *Arboretum Britannicum*, p. 1908.

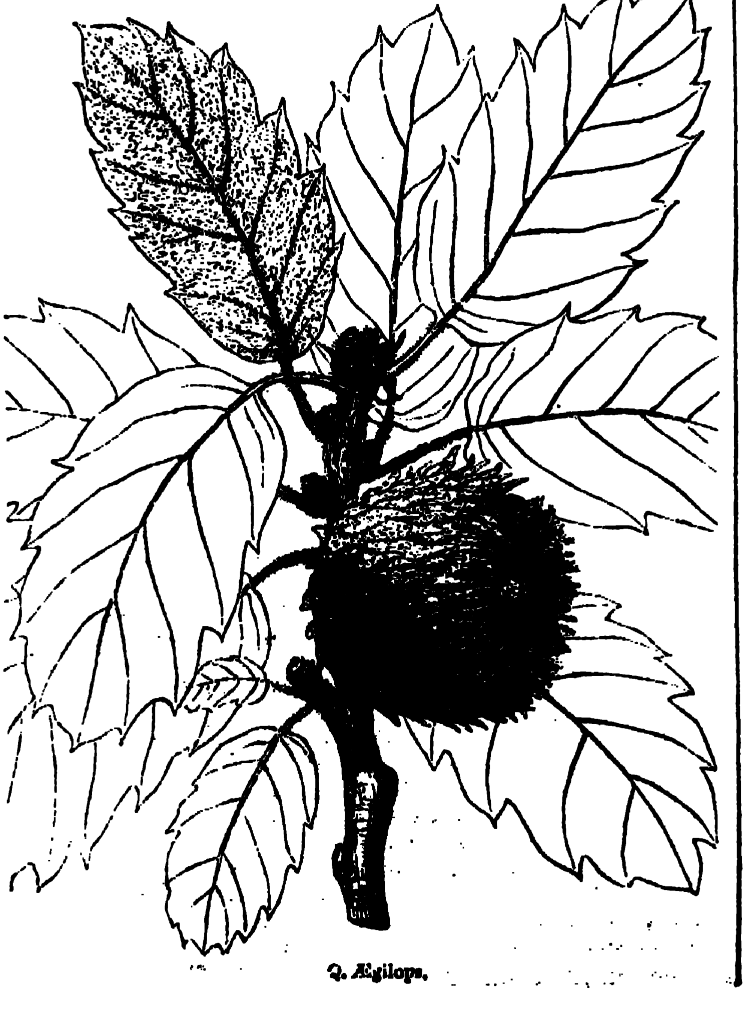
c. The Mossy-cupped Oaks (Cerres).

The species of this section are remarkable for their thin deeply pinnatifid leaves, the long narrow loose scales of their cup, and their equally long deciduous stipules. In this as in other parts of the genus, there is much confusion and uncertainty regarding both the limits of species and the quality of their timber.

Q. Cerris, Turkey Oak. Leaves deciduous, on very short stalks, oblong, deeply and unequally pinnatifid; hairy beneath; lobes lanceolate, acute, somewhat angular. Stipules longer than the footstalks. Cup hemispherical, with long loose hairy scales. An exceedingly common plant all over the south-east of Europe, where it seems to form some of the finest specimens of oak. It has an open, straight, graceful mode of growth, very different from the gnarled and tortuous appearance of native British oaks, than which it also grows much faster. It would seem to be unknown in Spain, where its place appears to be taken by the Q. hispanica of Lamarck. The gardens contain numerous varieties, the most striking of which are the half-evergreen Lucombe oaks, said to have been produced between the cork-tree and the Turkey oak, about the year 1762, by Mr. Lucombe, nurseryman, Exeter. This is however a statement that is open to some doubt: see *Q. Hispanica*. The timber of the Turkey oak is beautifully mottled, in consequence of the abundance of its silver grain; and there is reason to believe that it is, under favourable circumstances, equal to that of any other species. At least the Sardinian oak, so much valued and employed for ship-building, has the appearance of being produced by it. It is also reported to be much used for such purposes in Turkey and France. It is however probable that the Adriatic oak, which has turned out so ill in our dockyards, is the produce of the same species in an unfavourable climate. But this is however a matter of probability only, and requires confirmation. It is however certain, that the wood is very handsome, and well suited for indoor ornamental work; this has been found to be the case with the wood grown in England. (*Hort. Transactions*, 2nd series, vol. i., p. 338.)

Q. hispanica, the Spanish Oak. Trunk corky. Branches rather erect. Leaves nearly evergreen, lanceolate, acute, with fine serratures or crenatures, which are sharp-pointed, coriaceous, deep green, glaucous, and downy on the under side. Cups top-shaped, somewhat sessile, with shaggy, prickly, spreading scales. According to Mr. Barker Webb, this plant grows in Spain and by the Algerine river Monchique, and he reduces to it as synonyms the Q. crenata of Lamarck, Pseudosuber of Desfontaines, Ægilopifolia of Persoon, and the Lucombe oak of the English nurseries. He states that its leaves, stiffer fastigiate habit, turbinate cup, much shorter scales, and corky bark, clearly distinguish it from Q. Cerris: as to whether it is evergreen or deciduous, that depends upon the degree of cold to which it is subjected in winter; and he declares that upon comparing the authentic specimens of Desfontaines, Q. pseudosuber, with others cut from the original Lucombe oak, he finds them identical. The latter plant however is stated to have been raised at Exeter from seed between Q. Suber and Q. Cerris, an origin that was impossible in Spain; where however common Q. Suber may be, Cerris is not found in a wild state. We cannot pretend to reconcile these contradictory statements.

Q. austriaca, the Austrian Oak. Leaves on longish stalks, ovate-oblong, slightly but copiously sinuated, downy and hoary beneath; lobes short, ovate, acute, entire. Stipules shorter than the footstalks. Cup hemispherical, bristly. Of this plant, which is found in Austria, Hungary, &c., the leaves are larger and more deeply sinuated than in Q. hispanica, and the acorns are considerably larger; otherwise it is very like that species. It also approaches nearly to Q. Cerris, from which the shallow lobes of the leaves, and the stiffer and more bristly scales of its cups, seem to separate it. Hither is no doubt to be referred the Fulham oak of the English nurseries. That it is distinct from Q. Cerris there is no doubt, but it may be the same species as Q. hispanica.



Q. Ægilops.

Q. Ægilops, Great prickly-cupped Oak, or Valonia. Leaves ovate-oblong, with bristle-pointed tooth-like lobes, hoary beneath. Cup very large, hemispherical, with lanceolate, elongated, spreading scales. The Morea and adjacent countries produce this valuable tree, which yields the acorns called velani, or valonia, in commerce, of which nearly 150,000 cwt. are imported yearly for the use of tanners, and sold from 12*l.* to 15*l.* a ton. The tree is reported to be handsome in its own country; but with us, although it has long been cultivated, it is an inelegant tree, of a stunted mode of growth. What has been said of its elegant appearance and so forth, seems to belong to Q. Cerris.

II. *Oaks of the Levant.*

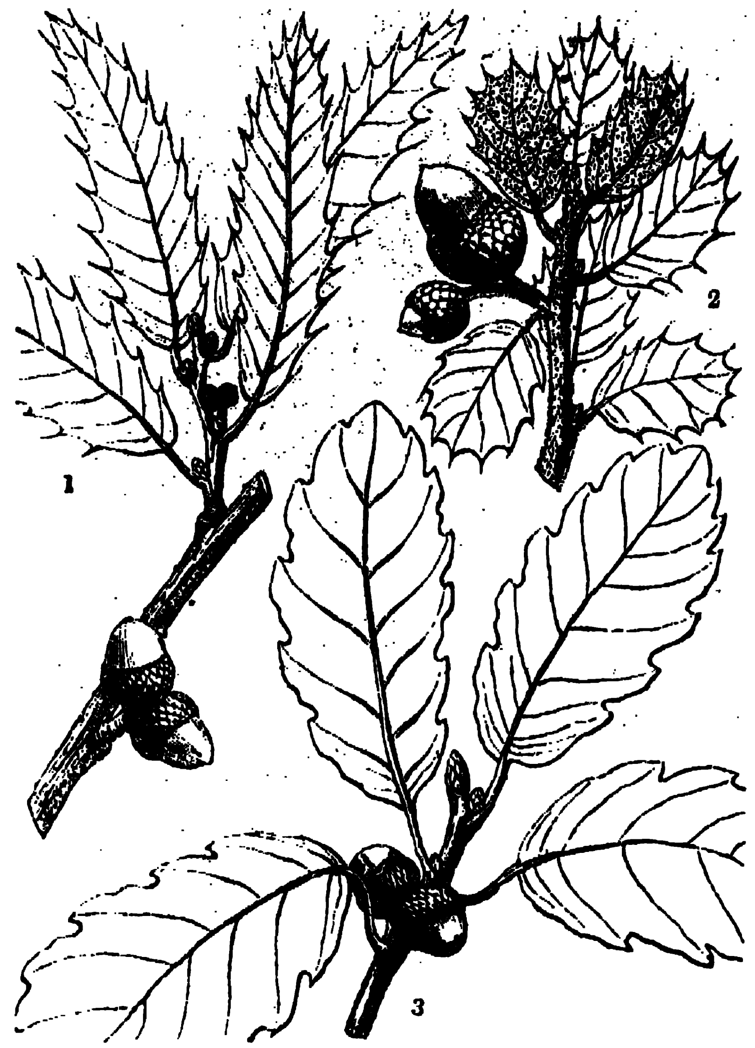
Little has hitherto been ascertained regarding the species of this part of the world. The French traveller Olivier brought home with him a plant very near Q. Cerris, the mossy-cupped oak, which he reported to be met with throughout great part of Asia Minor, and to furnish the wood employed in the arsenal of Constantinople. His specimens were examined by Lamarck, who called them Q. crinita, but little more is known about the species. Another plant, under the name of Q. rigida, has been published from Caramania, where the oaks are said to arrive at a great size and beauty; and the common gall-oak, Q. infectoria, has long been known. But there can be no doubt that the mountainous regions intervening between the Turkish empire and India produce oaks that require investigation, and three perfectly distinct species have in fact been lately sent from Koordistan. Of all that have yet been found in the countries of the East, we shall give a short account.

Q. crinita, Hairy-cupped Oak. Leaves on long stalks, oblong, deeply pinnatifid, downy beneath, lobes lanceolate, bluntish, nearly entire. Cup hemispherical, downy, bristly. A tree of Asia Minor, found by Olivier, and figured in his 'Travels,' t. 12, and said to be the same as an Armenian species met with by Tournefort, and after him called Q. Tourneforti; but this is doubtful. It is described as a large tree yielding excellent timber, employed extensively by the Turks in naval constructions. There is however very little in the accounts hitherto given of the plant to distinguish it from the common Turkey oak, Q. Cerris, with which Mr. Loudon combines it, but not upon satisfactory evidence.

Q. infectoria, Oriental Gall-oak. Leaves ovate-oblong, very smooth on both sides, deeply toothed, somewhat sinuated, deciduous. Fruit sessile. Cup tessellated. Acorn elongated, nearly cylindrical. A very common plant in Asia Minor, where its branches are attacked by an insect, the Cynips scriptorum, which punctures them, and causes the formation of the oak-galls so well known in commerce. It forms a scrubby bush rather than tree, and is of no value except for its galls. Its branches occasionally produce large brownish red tubercles, spongy within, which are by some supposed to be the apples of the Dead Sea, whose appearance was tempting, but which contained only dust and ashes.

Q. rigida, Stiff-leaved Oak. Leaves oblong, undivided, with spinous serratures, smooth, glaucous beneath, heart-shaped at the base. Footstalks bearded at the summit. Scales of the cup rigid, spreading. A native of Caramania, of Koordistan, and, according to Sibthorpe, of the Morea, but the last is doubtful. It is a handsome-looking plant, so far as can be judged from dried specimens, but nothing is known of its uses.

Q. Brantii, Mr. Brant's Oak. Branches, footstalks, and leaves underneath covered all over with thick short wool. Leaves heart-shaped, ovate, acute, with bristle-pointed teeth, ash-coloured, with starry down on the upper side. This is described in the 'Botanical Register' as being a most remarkable plant; the full-grown leaves being six inches long, including the footstalk, and three inches and a half across at the widest part, which is near the base. They are as downy as those of a young plane-tree. The species appears allied to Q. Ballota, a Spanish species.



1, Q. rigida; 2, Q. Ballota; 3, Q. infectoria.

Q. castaneæfolia, the Chesnut-leaved Oak. Leaves oblong-lanceolate, rather downy on the under side, coarsely serrated, with bristle-pointed lobes. Acorns nearly sessile, oblong, with the cups, when old, covered by reversed scales. A tree from the province of Mazanderan, reported to be very beautiful. The leaves are often from four to five inches long. Mr. Barker Webb states that it is the same as what has been called Q. Libani, and that it is remarkable for having large depressed fruit, with wide lozenge-shaped scales turned back at the point.

Q. regia, the Royal Oak. Leaves stalked, ovate-lanceolate, heart-shaped, wavy, with coarse sharp unequal serratures, on each side green, shining, and smooth. The lobes of the leaves terminated by a conspicuous bristle. From Koordistan. It is a noble species, with leaves as large as those of a Spanish chesnut, and very like them.

Q. mannifera, the Manna Oak. Leaves stalked, oblong, somewhat heart-shaped, cut; the lobes blunt, smooth above, downy beneath. Young acorns oval, stalkless, smooth. An inhabitant of the Koord Mountains, where it has lately been discovered by Mr. Brant, the British consul at Erzerum, who found that the Koords obtain a sweet mucilaginous substance from its branches and leaves by steeping them in boiling water at the hottest season of the year, and afterwards evaporating the water. This substance is made into cakes, and sold in the markets of the town of Van under the name of Ghiok-helvashće, 'the sweetmeat of heaven.' The species is very near Q. sessiliflora, especially a form of it which has been named Q. mongholica. See the *Botanical Register* for 1840, p. 39 of the miscellaneous matter.

Q. iberica, the Georgian Oak. Leaves ovate-oblong, downy beneath, sinuated, with short blunt somewhat emarginate lobes. Acorns nearly sessile. Cups hairy, with sharp-pointed scales. A native of Georgia. Bieberstein describes it as a tree with the appearance of Q. sessiliflora, of which he thinks it may be a downy variety. He distinguishes it from Q. pubescens by that species being smaller and more downy, and its young leaves and branches covered with woolliness.

III. *Oaks of the Himalayas, China, &c.*

Although a great deal of information has been collected by Indian botanists concerning the oaks of the cold provinces of India, China, and Japan, so far as the distinction of species is concerned, yet, as none of them have been yet introduced into general cultivation in Europe, although occasional specimens occur in the gardens of collectors of rare plants, and as we know little of the uses to which they are respectively applied, it will not be necessary to dwell upon them at much length. All travellers in the Himalayas testify to the abundance of oaks. The people employed by Dr. Wallich gathered a considerable number of species, and Dr. Royle assures us that they are found from moderate elevations up to the limits of trees. Among these, all from the lower regions are, no doubt, too tender for cultivation in Great Britain; but of the Alpine species some may be expected to prove hardy. We shall only notice the following:—

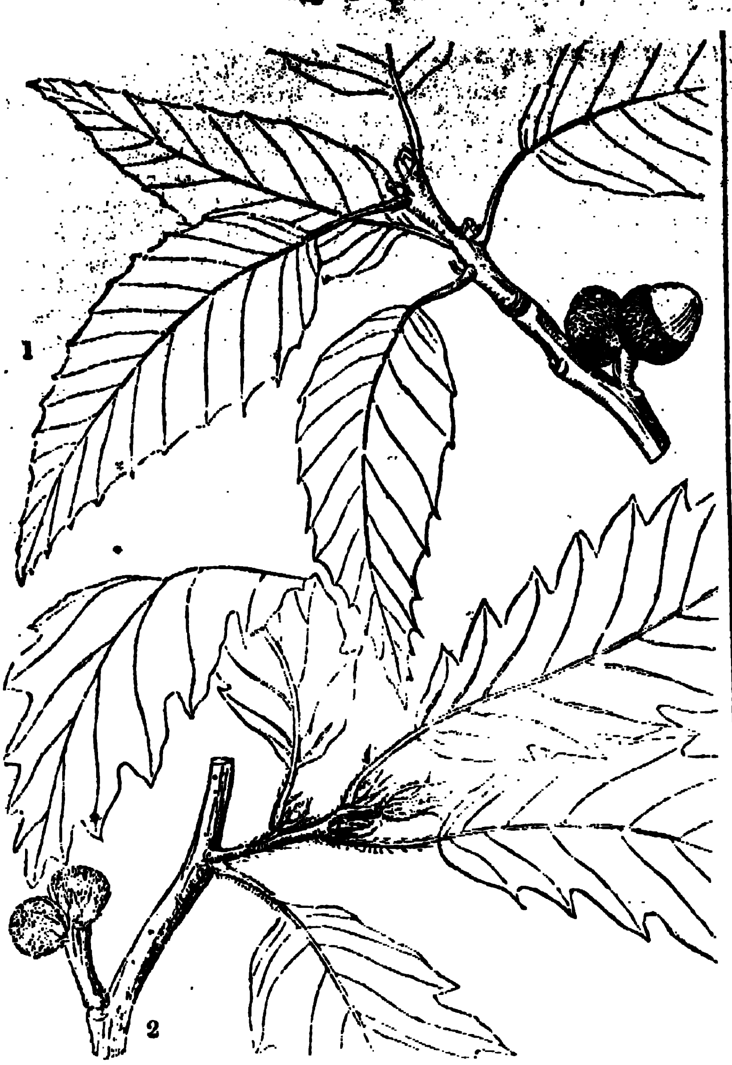
Q. semicarpifolia, Marking-nut leaved Oak. Leaves obovate, obtuse, coriaceous, entire; heart-shaped at the base; downy beneath; the young ones with spinous teeth. Acorns solitary or in pairs, on short downy stalks, depressed at the point, about twice as long as the shallow scaly cups. As this species occurs in the Himalayas at the upper limits of the forests, at even greater elevations than the Pines, it would, no doubt, suit the climate of England; and if so, its introduction would be very desirable, for it is stated to form a magnificent tree, whose timber is much esteemed by the natives. Dr. Wallich reports it to measure frequently 80 to 100 feet in height, with a girth of the trunk, at six feet above the ground, of fourteen to eighteen feet, and he says he has frequently met with individuals of far greater dimensions. See Wallich's *Plantæ Asiaticæ Rariores*, t 174.

Q. incana, the Himalayan Ilex. Leaves coriaceous, ovate-lanceolate, shining and smooth on the upper side, densely downy beneath, with coarse serratures which are not bristle-pointed. Acorns solitary, sessile, acute, but little protruded beyond the hemispherical downy cup, the scales of which are small and closely pressed. A beautiful tree, very like the evergreen oak of Europe. Its leaves are much more woolly on the under side. Dr. Wallich found it in Kumaon, where the people called it *Munroo*; Dr. Royle states it to be the *Ban* of the hill people, where he saw it, and that it occurs at moderate elevations. It is therefore in all probability tender.

Q. lanata, Woolly-leaved Nepaul Oak. Leaves elliptic-oblong, deep green, sharply serrated, coriaceous; densely woolly beneath. Fruit in very short axillary solitary spikes. Cup scaly, without prickles. This is one of the handsomest oaks yet discovered, and it exists in a living state in the gardens of this country, but, as might be expected from its native localities, it is not hardy enough to bear the climate of London without protection. In the Himalaya Mountains, where it is found wild, it is one of the first species that appears as the mountains are ascended, and it is there associated, according to Dr. Royle, with the Tree Rhododendron. In his 'Arboretum Britannicum,' Mr. Loudon supposes this to be the same as Roxburgh's Q. incana, quite a different plant, not yet known in England in a living state.

Q. annulata, Ring-cupped Oak. Leaves obovate, taper-pointed, serrated in their upper half; somewhat glaucous and silky beneath. Acorns axillary, sessile, ovate, with the cup furrowed concentrically. Plants of this occur in our gardens; but they are too tender for the climate of London. In the Himalayas the species is said to form a very large tree, with excellent timber. The leaves are something like those of a sweet bay-tree, but more glaucous on the under side, and with a longer point. The Parbutties are said to call it *Phullaat*, whence Q. Phullata, one of its names. It may be as well to remark that the fig. 1805, of Loudon's 'Arboretum Britannicum,' p. 1922, given for this species, has no resemblance to it.

Q. chinensis, the Chinese Oak. Leaves ovate-lanceolate, taper-pointed, with bristly shallow serratures, and very long footstalks; slightly downy on the under side. Acorns globose, sessile, in pairs. Cups with hoary lanceolate scales, the exterior of which are reflexed, and longer than the acorn. A beautiful Chinese species, found (by the botanists attached to the Russian mission to Pekin) in mountainous places. It is said to have exactly the habit and appearance of a Spanish chesnut. We give a figure of it from specimens communicated by Dr. Bunge, its discoverer.



1, Q. chinensis; 2, Q. castaneæfolia.

IV. *Oaks of the United States of North America.*

In general these are cultivated in England, where they are found tolerably hardy. They however evidently suffer from want of summer heat, and are by no means of the same value to us as the species of the continent of Europe; and it may be doubted whether any of them are ever, in their own country, such noble trees as the finest specimens of Q. pedunculata and sessiliflora. We shall only mention the kinds common in the plantations of Great Britain.

Q. alba, White Oak. Leaves oblong, deeply pinnatifid, glaucous beneath, lobes linear-oblong, obtuse, entire, dilated upwards. Fruit stalked. Cup depressed, warty. A very fine species, producing sweet acorns and excellent timber, and approaching nearer to the European forms than any other American species. Specimens of it in the American forests are often 70 or 80 feet high.

Q. Prinus, Chesnut-leaved White Oak. Leaves on longish stalks, obovate, acute, somewhat downy beneath, with nearly equal dilated, callous-tipped, tooth-like serratures. Cup contracted at the base. Acorn ovate. A tree of considerable beauty, varying considerably according to soil and situation, and hence divided by some writers into many species, called Q. palustris, montana, monticola, acuminata, Castanea, pumila, Chinquapin, prinoides, tomentosa, discolor, &c., under all which names it is propagated in the nurseries. The wood is porous, and not of very good quality, but the broad bright green foliage is handsome.

Q. coccinea, Scarlet Oak. Leaves smooth, oblong, deeply and widely sinuated, on long stalks, lobes divaricated, acute, sharply toothed, bristle-pointed. Cup turbinate, half as long as the acorn. The middle States of North America abound in this and the following species, which derive their name from their leaves becoming in the autumn of a rich crimson colour. It forms a large and graceful tree, but the head wants massiveness. The wood is of very little value, and perishable; it is only employed for fuel and for staves for casks intended to hold dry goods. It grows fast, and stands the climate of even the colder counties of England.

Q. rubra, Mountain Red Oak. Leaves smooth, oblong, sinuated, on long stalks, lobes acute, sharply toothed, bristle-pointed. Cup flat underneath. Acorn ovate. A specimen of this is said by Mr. Loudon to exist at Strathfieldsay 100 feet high; it is very like the last species, but its leaves become more purple in the autumn. Its wood is of bad quality.

Q. tinctoria, Dyer's Oak, Black Oak, or Quercitron. Leaves downy beneath, obovate-oblong, dilated, widely sinuated; lobes short, obtuse, slightly toothed, bristle-pointed. Cup flat underneath. Acorn globose. A native of Pennsylvania and of the mountains of the Carolinas and Georgia, where it becomes a very large tree, with a bark so dark-coloured as to have gained for it the name of black oak. The leaves are large and very handsome, becoming dull red or yellow in the autumn. Its wood is strong, but very coarse. The inner bark abounds in a yellow dye of great brilliancy, which is known in trade under the name of quercitron; large quantities of it are annually imported from Philadelphia.

Q. Phellos, Willow Oak. Leaves membranous, linear-lanceolate, tapering to each end, entire, smooth, with a small point. Acorn roundish. Low swampy forests on the sea-coast of the southern states of North America. A large tree with something the aspect of a willow, whence its name. Its timber is stated to be strong, but very coarse. Q. laurifolia and imbricaria are nearly related to it.

Q. virens, Live Oak. Leaves coriaceous, elliptic-oblong, revolute, entire, pointless; obtuse at the base, clothed with starry down beneath. Fruit stalked. Acorn oblong. A very valuable species, confined to the Southern States of the North American Union, where it is most abundant upon the shores of creeks and bays. It is also abundant in Texas. The Live Oak yields the best oak of America, the timber being heavy, compact, and fine-grained; and is extensively employed in the American dockyards, although it does not usually acquire a large size. The acorns are stated to be remarkably sweet. It is much too tender to suit this climate; and consequently specimens are to be found only in curious collections in sheltered warm situations.

V. *Oaks of Mexico.*

These are extremely numerous, and must in many cases form highly ornamental trees. Several species have recently been introduced by the Horticultural Society, but we at present know nothing of their habits. It is to be feared that they will in general prove too tender for England.

Q. acutifolia, Sharp-leaved Oak. Leaves heart-shaped, lanceolate, tapering to a very sharp point, with coarse pointed teeth, covered with rusty down on the under side, especially along the principal veins. Young acorns in spikes, which have a short footstalk. Forests of this tree occur on the road from Acapulco to Mexico, where it is called *Aguatle*. It is described as a large tree producing timber of excellent quality.

Q. sideroxyla, the Iron-wood Oak. Leaves oblong, somewhat wedge-shaped, obtuse at the base, armed towards the upper end with sharp-pointed teeth; hoary on the under side. Acorns sessile, ovate, seated in a roundish cup. Found in Mexico, near Guanajuato, and in other places, in dry barren places 6000 or 7000 feet above the sea. It forms a large tree of great beauty. Its timber is very hard, takes a fine polish, and is extremely durable when used under ground or when sunk under water.

Q. lanceolata, the Lance-leaved Oak. Leaves lance-shaped, entire, wavy, shining on the upper side, strongly bearded beneath at the principal angles of the veins. Acorns oval, sessile, in goblet-shaped cups. Common in Mexico at the height of 5000 or 6000 feet. It is a large tree, producing a very hard wood, very durable when used under ground, and extensively consumed in mining operations.

Q. glaucescens, Blue-leaved Oak. Leaves on very short stalks, wedge-shaped, obovate, entire near the base, slightly toothed and indented at the edge, glaucous, very smooth. Acorns in racemes. Common in Mexico at the height of 2000 feet above the sea; its wood furnishes the greater part of the charcoal used in that country.

Q. obtusata, the Blunted Oak. Leaves oblong, blunt at each end, unequal at the base, bent inwards near the middle, on the under side strongly veined, and covered with a powdery down. Acorns spherical, in axillary racemes, almost entirely covered by a scaly cup. A fine tree, native of the Mexican mountains 6000 feet above the sea. Wood very compact and strong, and capable of taking a fine polish.

Q. macrophylla, Large-leaved Mexican Oak. Leaves obovate, crenate, tapering and heart-shaped at the base, downy beneath. Fruit spiked. This is doubtless the finest oak in the world. It inhabits the southern parts of Mexico and Guatemala, and has leaves 12 to 18 inches long, and broad in proportion. Its acorns are as large as French walnuts; they have been received in this country by the Horticultural Society, but unfortunately would not vegetate.

For detailed information concerning the species of oaks, the reader is referred to Blume's *Flora Javæ*; the article 'Quercus' in Rees's *Cyclopædia*; Webb's *Iter Hispanicum*; Humboldt and Bonpland's *Plantæ Æquinoctiales*; and Loudon's *Arboretum Britannicum*, vol. iv.

QUERCUS PEDUNCULATA (Willd). The bark of this species, the true British oak, is used in medicine. Its appearance varies with the age of the bark, as well as of the tree from which it is obtained. Its excellence is determined by the period of the year when the tree has been barked. The best is obtained from coppice oaks, not from old or full-grown trees, and is better from the branches than the trunk. According to Sir H. Davy, the greatest quantity of tannin exists in the bark in spring, at the time when the buds begin to open (*Agricul. Chemistry*, 4th ed., p. 87), which is confirmed by Biggins. This is the period usually selected to decorticate the trees, owing to the greater ease with which it is then effected, the cambium which exists between the bark and wood allowing of their easier separation. The interior cortical layers are much richer in the active principles than the external ones.

Oak-bark is commonly met with in pieces from one to two feet long. That from young stems or branches is generally thin, tolerably smooth, having a silvery or ash-grey cuticle, and frequently clothed with lichens, chiefly of the genus Verrucaria or Opegrapha. When newly detached it is whitish internally, but by exposure to the air it deepens into brown, and becomes fibrous and cracked. The bark of old stems is much thicker, very rough and cracked, and greatly inferior in quality. The chief chemical constituents are: tannin (impure tannic acid), tannates of lime, magnesia, potash, &c., gallic acid, uncrystallizable sugar, pectin, and lignin. It has the peculiar and well known odour of tan, and a bitter astringent but afterwards sweetish mucilaginous taste.

Oak bark possesses all the properties of astringent substances, except the power of decomposing tartar-emetic. [Astringents; Antimony.] It is more employed externally than internally as a wash or injection. By long continued application, it can almost tan the living tissue, and either strengthen a weak part of the skin, or convert a secreting into a non-secreting surface, as in cases of prolapsed or inverted uterus. One of the most valuable applications, and at the same time cheapest, to surfaces threatened with gangrene from pressure, as in fevers, or old bedridden persons, is a wash formed by digesting oak-bark in weak distilled vinegar, and after straining, adding hydro-chloride of ammonia. It is not only unnecessary but injurious to make a decoction of oak-bark: no tanner would think of boiling his oak-bark before steeping his hides it.

Powdered oak-bark with chamomile flowers is a cheap and often effectual mode of checking the paroxysms of agues. (Cullen's *Mat. Med.*; Pereira's *Mat. Med.*)

QUERCUS INFECTO'RIA. [Galls.]

QUERCY, a district forming part of the antient province of Guienne. [Guyenne and Gascogne.] It was bounded on the north by Limousin, on the north-east by Auvergne, on the east by Rouergue (another subdivision of Guienne), on the south by Languedoc, on the west by Agenais, and on the north-west by Perigord (the two latter being subdivisions of Guienne). The district of Quercy was subdivided into Le Haut (or Upper) Quercy, which comprehended the chief town Cahors (population 12,417), Gourdon (population 5334), Figeac (population 6237), and other places; and Le Bas (or Lower) Quercy, which comprehended the chief town, Montauban (population 23,865), Moissac (population 10,618), and other towns. The population is according to the census of 1836.

Le Quercy was chiefly comprehended in the territories of the Cadurci, a Celtic people, from whom its name by corruption is evidently derived. It belonged successively to the Visigoths and the Franks; and was in the possession of Eudes, duke of Aquitaine, who was driven from it by Pepin. It was erected into a county by Charlemagne, and subsequently came into the hands of the counts of Toulouse. Having been wrested from these in the wars against the Albigeois, it was ceded to the English, from whom it was taken by Charles V. It is now included in the departments of Lot and of Tarn et Garonne.

QUERE'TARO, a town in Mexico, in the state of Queretaro, is situated near 20° 32′ N. lat. and 100° 10′ W. long., on the table-land of Anahuac, at an elevation of 6362 feet above the sea. The town with its suburbs contains a population of between 30,000 and 40,000. It is rather a well-built place. The site is not quite level, nor are the streets laid out with much regularity, but they abound with fine buildings and large churches and convents. The finest edifices are the churches of Guadalupe, and the convents of S. Francisco and Santa Clara, the latter of which contains 250 females, consisting of 70 nuns, and as many young ladies sent there for their education, with lay sisters and attendants. In the middle of the town is a great square surrounded with well-furnished shops. The suburbs consist of mud houses, with only one mud floor, and are almost exclusively inhabited by Indians, the number of whom is said to amount to 12,000. The town is well supplied with water from a spring in the mountains, about ten miles distant: the water is conveyed by an aqueduct, which rests on lofty light and bold arches, and its vast extent gives it an air of great magnificence. About three or four miles from the town is one of those deep depressions which frequently occur on the table-land, and which are so much below its general surface that they are partly clothed with the vegetation of a *tierra caliente*. This depression is called El Pareo de la Cañada, and is used by the inhabitants as a place to take their evening walks in.

Cotton and woollen stuffs are made; but these manufactures were formerly of much greater extent than they are at present. Humboldt states that the goods manufactured in this town at the end of the last century amounted annually to 600,000 Spanish dollars (135,000*l.*). Though the cotton-manufactures have much decreased since the ports have been opened and the English have got into the market, there are still made a great number of *mantas* and *rebozas*, or cloaks for men and women. The manufactures are divided into two classes, the *obrages* and *trapiches*; the former comprise all the establishments that can employ from ten to thirty looms, and the latter those in which only two or three are in activity. Part of the manufactured goods is retailed in the great plaza, where a market is held every evening by torchlight, and part is sent to the capital and other large towns of the Confederation. The woollen-manufactures are now principally kept up by a government contract for supplying the army with clothing. Wool as well as cotton is brought from the states lying farther north, but the best wool is the produce of the state of Queretaro. The town also carries on a considerable commerce in corn and potatoes, as it is situated in the eastern district of the tract called Baxio, which is the richest in agricultural produce in the United Mexican States, and great quantities of corn and potatoes are sent to the mining district, which comprehends the the eastern part of the state.

(Humboldt, *Essai sur la Nouvelle Espagne*; Ward's *Mexico in* 1827; Poinsett's *Notes on Mexico*; Hardy's *Travels in the Interior of Mexico*; *Sketch of the Customs and Society of Mexico*.)

QUERI'NI, A'NGELO MARI'A, CARDINAL, born at Venice, of an illustrious patrician family, in 1680, studied first at Brescia under the Jesuits, and at the age of seventeen entered the Benedictine order. Having become well acquainted with Greek, Hebrew, and biblical learning, he was made instructor of the novices, for whom he wrote a dissertation, 'De Mosaicæ Historiæ Præstantia.' He afterwards travelled during four years in France, England, Holland, and Germany, and enjoyed the society of some of the most distinguished men of those countries. In his 'Commentarii de Rebus ad se pertinentibus,' he gives some account of what he saw, and the conversations he had with many learned men. On his return to Italy, he published several works on liturgic antiquities:—1, 'Vetus Officium Quadragesimale Græciæ Orthodoxæ;' 2, 'Diatribæ ad priorem partem veteris Officii;' 3, 'De Ecclesiasticorum Officiorum apud Græcos Antiquitate;' 4, 'De Hymnis Quadragesimalibus Græcorum;' 5, 'De aliis Canticis Quadragesimalibus.' In the year 1721 Querini was made archbishop of Corfu; and he illustrated the antiquities and history of that island in his 'Primordia Corcyræ' and other works. In 1728 he was transferred to the see of Brescia, and soon after he was made a cardinal, and librarian of the Vatican. It was after his promotion to the see of Brescia that he wrote his literary history of Brescia, 'Specimen Brixianæ Litteraturæ quæ post Typographiæ Incunabula florebat,' 1739. He also published the Lives of Paul II. and Paul III., in the former of which he endeavoured to clear the memory of that pope from the charges of Platina and other historians [Paul II., Pope]; and he edited a collection of the epistles of Cardinal Reginald Pole. His other works consist of dissertations upon literary subjects, both sacred and profane, and of numerous epistles, chiefly in Latin. Cardinal Querini was in every respect one of the most distinguished prelates of the Roman church in the eighteenth century. Spotless in his morals, modest and simple in his habits, generous, meek, and charitable, he conciliated the esteem of men of all countries and opinions. Frederic the Great wrote to him in the most flattering terms. Voltaire dedicated to him his tragedy of 'Semiramis' and other works. Querini laboured particularly to improve the town of Brescia, of which he was bishop: he completed the structure of its handsome cathedral, founded a clerical college, a house for female instruction in the Val Camonica, and, lastly, he established the public library of Brescia. He sent donations to Berlin to complete the Catholic church there. By his will he bequeathed his property to benevolent purposes. Cardinal Querini died in 1755, generally regretted. (Corniani, *Secoli della Letteratura Italiana.*)

QUERQUE'DULA. [Ducks; Teal.]

QUE'RULA. [Muscicapidæ, vol. xvi., p. 11.]

QUERULI'NÆ. [Muscicapidæ, vol. xvi., p. 11.]

QUESNAY. [Political Economy.]

QUESNOY, LE. [Nord.]

QUEVEDO Y VILLEGAS, FRANCISCO GOMEZ DE, an eminent Spanish satirist, was born at Madrid, in September, 1580, not in 1570, as the authors of the biographical notice printed at the beginning of his translated works (Edin., 1798) erroneously assert. His father Pedro Gomez de Quevedo had been secretary to the empress Mary, and afterwards filled the same situation to Queen Anne, wife of Philip II. His mother Doña Maria de Santibañez was lady of the bedchamber to the queen. Both were of noble family, and descended from the most antient landed proprietors in the Valle de Toranzo. His father having died when he was a child, Quevedo was brought up in the royal palace by his mother. He was sent early to the university of Alcalá, where he made such progress in his studies that he took his degree of doctor in theology at the age of fifteen, a fact which would appear almost incredible. Grown weary of theology, Quevedo applied himself with ardour to the study of civil and canon law, medicine, and natural history; the learned languages, and the various systems of philosophy were also in the number of his acquirements. It is probable that at this period of his life he injured his sight by constant reading, for he was ever after incapable of distinguishing any object at the distance of three paces without the aid of glasses. But neither this deformity nor the crooked legs which he received from nature deterred him from mixing in fashionable society, and being considered a very accomplished cavalier. He is said to have been very gallant towards the fair sex, but exceedingly jealous of his honour and that of his friends; he could wield all weapons of defence with singular dexterity; and as he was endowed with much strength and courage, he remained victorious in several encounters. In one instance however his antagonist, who was a man of quality, having been severely wounded, Quevedo was compelled to quit the court, and repair to Naples, where he was kindly received by the Spanish envoy Don Pedro Giron, duke of Osuna, who not only retained him in his service, but procured his pardon at Madrid. Whilst at Naples, Quevedo executed some very important commissions with which he was entrusted by the viceroy. He crossed the sea seven times as ambassador to Madrid, and went also to Rome on a secret mission. It is even said that he was concerned in the celebrated Bedmar conspiracy at Venice, which city he entered disguised as a beggar. [Venice.] On the fall of his patron, who was recalled to Madrid, and cast into a dungeon, where he ended his days, Quevedo returned to court; but scarcely had he arrived there when he was himself arrested, and confined to his country-seat, la Torre de Juan Abad, upon the charge of being the author of certain libels on the government. After three years of close confinement, Quevedo's papers having been examined, and his innocence proved, he was allowed to revisit the court; but, tutored by experience, he refused many important offices that were offered to him, and continued to lead a country life wholly devoted to literary pursuits. It is probable that at this period he wrote the poems which appeared afterwards under the feigned name of El Bachiller la Torre. He soon after wrote his 'Politica de Dios' y Govierno de Christo,' which he dedicated to his patron the Duke of Osuna, and which was printed for the first time at Barcelona in 1629, 8vo. Quevedo was upwards of fifty years of age when he married; but his wife, to whom he was tenderly attached, did not live long. This induced him to revisit Madrid, where in 1641 he was again arrested on the charge of libel, and cast into prison, where he remained for nearly two years. At last Quevedo having appealed for justice to the Conde Duque de Olivares, the all-powerful minister and favourite of Philip IV., his case was for the first time investigated, when it was ascertained that the libellous publication attributed to him was the production of an obscure monk. He was consequently released, and allowed to retire to his country-seat; but the loss of a considerable portion of his fortune, which had been sequestrated during his confinement, and a chronic disease contracted in his prison, shortened his days, and he died some time after, in the neighbouring town of Villanueva de los Infantes, on the 8th of September, 1645, at the age of sixty-five.

Quevedo was undoubtedly one of the best writers of his age; and, with the exception of Cervantes, no Spanish author has ever displayed more originality in his writings. He excelled equally in verse and prose. 'His heroic pieces,' says Nicolas Antonio (*Bib. Nov.*, vol. i., p. 460) 'have great force and sublimity; his lyrics, great beauty and sweetness; and his humorous pieces, a certain easy air, pleasantry, and ingenuity of turn which is really delightful to the reader.' He appears as the rival of Gongora in numerous comic *letrillas* and romances in the old national style. But it is as a prose writer that Quevedo has acquired fame out of his own country. His prose writings are of two sorts, serious and comic: the first consist of pieces written upon moral and religious subjects; the latter are satirical and full of wit and humour; the style however in which they are written is at times so quaint as to be almost unintelligible to strangers. They were nevertheless translated into almost every language of Europe. His *Sueños*, or Visions, enjoyed the greatest celebrity. They consist of various visions of the other world, in which the author sees the end of earthly vanities, and the punishment that awaits crime. Great knowledge of human nature is displayed in them; and as to wit and humour, they are almost inimitable. Shortly after their first appearance (Mad., 1649) they were translated into German by Moscherosch. They were subsequently put into English by Sir Roger l'Estrange (Lond., 1668, 8vo.), and were so well received by the public, that in 1715 there appeared an eleventh edition of them. A new translation of them was published by Pineda (Lond., 1734, 8vo.). Lastly an edition in three volumes small 8vo. was published at Edinburgh in 1798, containing the following works by Quevedo, besides his Visions: 'The curious history of the Night Adventurer,' 'The Life of Paul the Spanish Sharper,' 'Fortune in her Wits,' 'Proclamations by All-Father Time, a treatise of all things whatsoever, past, present, and to come,' Letters on several occasions, &c. The works of Quevedo have been repeatedly printed in and out of Spain. The first edition of his collected works appeared at Madrid in 1649-64, 2 vols. 4to. They were then reprinted at Brussels in 1660-61, 3 vols. 4to., with a portrait of the author, and afterwards at Antwerp in 1669. A princely edition, with many important additions, was published at Madrid, by Harra, in 1772, 6 vols., in large 4to; but the best is undoubtedly that of Sancho, in 11 volumes, 8vo. (Mad., 1790-94), as it contains much that is not to be found in any of the preceding ones. Several detached pieces by Quevedo, till then inedited, were published about the close of the last century, in the first, third, sixth, and fifteenth volumes of the collection entitled *Semanario Erudito*; a few also of his fugitive poems may be found in the *Parnasso Español*. Quevedo wrote also several dramas and some historical works, but these have been lost to literature. Indeed there is every reason to believe that we possess in print but a small portion of Quevedo's writings, since his friend Antonio de Tarsia, who wrote his life (Mad., 1663), informs us that 'not a twentieth part of Quevedo's writings had then escaped destruction.'

('Vida de Quevedo por el Abad de Tarsia,' in the 6th volume of the 'Obras de Quevedo,' Madrid, 1772; Nicolas Antonio, *Bib. Hisp. Nov.*, vol. i.; Quintana, 'Poesias Selectas Castellanas.')

QUI TAM. In those statutes by which certain acts are prohibited under a penalty, it is usual to encourage the enforcing of the penalty by appointing the whole or some part of it to be paid to the person who shall take the risk and trouble, and incur the odium, of bringing the matter before a court of law. Where the part of the penalty not given to the informer is directed to be paid over to the poor of the parish, or to be applied for other purposes, the informer may, if he think fit, sue in his own name only; but where a part, commonly a moiety, is given to the king, the proceeding is in the following form: 'A. B., who, as well (qui tam) for our lady the queen as for himself, in this behalf prosecutes, complains,' &c.

When a qui tam or other penal action is commenced, no other person can afterwards sue the defendant in respect of the same offence, whatever the result of the first action may be. It is therefore not unusual for offenders against penal statutes to seek to protect themselves by procuring one of their friends to sue. This however will be of no avail against a subsequent informer suing *bonâ fide*, provided the fraud and collusion in getting up the first action can be shown.

QUIA EMPTO'RES. [FEUDAL SYSTEM, p. 246.]

QUIBERON. [MORBIHAN.]

QUICK HEDGES. [HEDGE.]

QUICKSILVER. [MERCURY.]

QUIETISM is the name of the doctrine of certain ascetic Christians, who taught that the chief duty of man was to be wrapped up in the continual contemplation and love of God, so as to become totally independent of outward circumstances and of the influence of the senses, and they contended that when a man arrived at this state of perfection, the soul had no further occasion for prayer and other external devotional practices. Quietism is in fact the extreme of asceticism and of contemplative devotion. There have been men so disposed in all ages of Christianity, without forming a sect, and even the Mohammedans and Brahmins have their Quietists; but it was a Spanish priest called Michael Molinos, in the seventeenth century, who first embodied the principles of Quietism in his works, which were condemned at Rome, where the author was imprisoned and died in 1696. About the same time Madame Guyon, or Guion, in France, showed herself a great advocate of Quietism. Her maiden name was De la Mothe, and she was of a noble family of Auvergne. She married a wealthy man of the name of Guion, who after a few years left her a young widow with three children and a large property. Madame Guion had been from her youth piously inclined, and after her husband's death she became an enthusiast. Her spiritual director, Father Lacombe, shared the same feelings, and he wrote an ascetic work, entitled 'Analyse de l'Oraison Mentale.' Jean d'Aranthon, titular bishop of Geneva, knew Madame Guion, and esteemed her much, but he did not altogether approve of the vehemence of her zeal, and of her endeavours to introduce her devotional system into various convents. The monks particularly objected to the disuse of external forms of devotion, without which, they contended, it was impossible to keep up the internal warmth of piety, and they contended also that it was impossible to continue in a perpetual state of contemplation. Madame Guion, having fixed her residence at Paris about 1688 or 1689, became acquainted with several ladies of rank, and among others with Madame de Maintenon, and also with the Abbé de Fénélon, who was then preceptor of the young duke of Burgundy. In a work entitled 'Moyen court et trés facile de faire Oraison,' Madame Guion insisted upon the necessity of praying internally with the heart rather than with the lips, and she declared that without internal prayer all other religious practices were useless. There seems to be nothing indicated by the title of this work, which has not been recommended by many of the most exemplary Christians and divines, from the age of the apostles to the present day, among whom are several whom the Church of Rome numbers among its saints. Another work of Madame Guion, 'Les Torrents Spirituels,' is a continuation of the former, and she wrote also an interpretation of Solomon's Song, in an allegorical and mystical sense; a task which appeared rather awkward for a pious lady, but which she evidently undertook with all purity and sincerity. Bossuet however thought that there was much reprehensible matter in her works in point of doctrine, and caused her to be confined in a monastery in the year 1695, and obliged her to sign a condemnation of several passages, or rather an explanation of them in an innocuous sense, which she readily did. After six months she was restored to liberty; but she was again arrested, by order of the archbishop of Paris, and sent to the Bastille, where she was detained for several years. The archbishop styled the contents of her books 'a monstrous and diabolical system.' Fénélon undertook her defence, and this led to a hot controversy between him and Bossuet, and ended in the condemnation of Fénélon by Rome in 1699. [FENELON.] Madame Guion was at last liberated, and retired to Orleans to live with some friends. She died in 1717. (*Préface Générale*, prefixed to the *Opuscules Spirituels de Madame de la Mothe Guion*, Cologne, 1704.)

QUIE'TUS was the son of Macrianus, an officer of distinction in the service of Valerianus. When that emperor was defeated and taken prisoner by the Persians (A.D. 260), the soldiers offered the empire to Macrianus the elder, who refused it on account of his age, but accepted it for his two sons Macrianus the younger and Quietus. In the meantime, Gallienus, the son of Valerianus, had been proclaimed Augustus at Rome; but his authority was not acknowledged beyond the limits of Italy, and numerous usurpers arose in the various provinces of the empire, who have been styled 'the thirty tyrants.' Aureolus, one of these, attacked the two Macriani, father and son, on their march through Thrace, defeated them, and put them to death. Quietus, who was a mere youth, appears to have remained behind in Asia. Being seized by Odenatus, prince of Palmyra, who assumed the command of the Roman armies in the East, he was put to death. (Trebellius Pollio, *Triginta Tyranni*, in *Historia Augusta*.)

Coin of Quietus.
British Museum. Actual size.

QUILIMANE. [MOZAMBIQUE, COAST OF.]

QUILLEBŒUF. [SEINE INFERIEURE.]

QUILO'A, called at present by the natives Keelva, is on the east coast of Africa, near 9° S. lat. and 39° 30′ E. long. It was a large town when the Portuguese first visited these countries, and the king held the sovereignty of Sofala, Mozambique, and the intervening ports. In 1505 it was taken by Francisco de Almeida, after a desperate resistance on the part of the inhabitants, which induced him to burn the town. Since that time it has never had any degree of prosperity. At a later period the Portuguese erected a fort, but the bad climate soon obliged them to abandon it. Quiloa is now a miserable village, subject to the Iman of Muskat. Part of the walls of the city still remain in a tolerably perfect state, and there are also the ruins of some extensive buildings. The fort, which still exists, and is garrisoned by the Arabs, is a substantial building of stone, and capable of containing a numerous garrison. The harbour is one of the finest on the coast, but has no anchorage outside, as the water is unfathomable. It consists of a wide basin, which branches off into several arms, which run a considerable distance inland. (Owen's *Narrative of a Voyage to explore the Shores of Africa, Arabia, and Madagascar.*)

QUILON. [HINDUSTAN, vol. xii., p. 204.]

QUIMPER, or more fully **QUIMPER CORENTIN**, a city in France, chief town of the department of Finistère, one of the departments into which Bretagne has been divided. It is at the junction of the river Benaudet with the Odet, which here becomes navigable; 294 miles in a direct line west by south of Paris, or 319 miles by the road through Versailles, Dreux, Alençon, Mayenne, Fougères, Rennes, Plöermel, Hennebon, and Quimperlé; in 48° 0′ N. lat. and 4° 9′ W. long.

The name Quimper (Kimper), which in the Celtic tongue denotes 'junction,' indicates that the town is of Celtic origin, and is descriptive of its situation. In the 'Notitia Provinciarum Galliæ,' it appears under the name Corisopiti, or rather that name belonged to the nation whose chief town it was, and who appear to have been either a subdivision of the Osismii, or else subject to them. In the Latin of the middle ages the diocese established here was called Corisopitensis, while the town itself was called Confluentia, which is a translation of its Celtic name. It has been successively called Quimper Odet and Quimper Corentin, and was capital of the county of Cornouailles in the middle ages. In the war of the Breton succession, about the middle of the fourteenth century, Quimper suffered much. Charles de Blois exercised the greatest cruelties there, and the greater part of the inhabitants were slaughtered. It was besieged by the English auxiliaries of De Montfort, but did not surrender till after the decisive victory of Auray, A.D. 1364. In the Breton war, the sequel to the war of the League, Quimper embraced the party of the duke of Mercœur, but submitted in 1595 to Henri IV.

The town is divided into the old town and the new town. The old town, situated on a rising ground, in the angle formed by the junction of the two streams, is surrounded by antient walls and towers: it has narrow streets, with the upper stories of the houses projecting over the street: the quay is lined with houses of Gothic architecture and irregular construction. The new town has wider streets than the old town; it is commanded on one side by rocky heights, rising to the height of 500 or 600 feet, covered with wood and heath, and of picturesque appearance. The cathedral, rebuilt early in the fifteenth century, is one of the noblest churches in France: the other principal buildings are the town-hall, the hospital, the barracks, and the college. There is a public walk.

The population of the commune, in 1826, was 10,032; in 1831, 9860; in 1836, 9715: showing, by its gradual diminution, the decline of the town. Quimper does not appear to have any manufactures except of hats and of coarse earthenware. Small vessels are built. The Odet is navigable up to the town for vessels of 300 tons, and by means of it considerable trade is carried on: the exports are corn, honey, linen and hempen cloth, horses, butter, tallow, and dried or salted pilchards or other fish; the imports are colonial produce and salt. There are thirteen fairs in the year. The pilchard fishery is very actively carried on. The neighbouring country is comparatively sterile: it is chiefly laid out in pasture-ground, in which many horses are reared, of small size, but great speed. Some coal is found, but we are not aware that it is worked. There are a subordinate court of justice and a commercial court, several fiscal government offices, an exchange, a public library of 7000 volumes, a high school, with a collection of the objects of physical science, an agricultural society, a departmental nursery-ground, a theatre, public baths, a seminary for the priesthood, and schools for navigation and drawing.

Quimper was the birth-place of Fréron, a critic and man of letters of some eminence; and of the Jesuits Bougéant and Hardouin [HARDOUIN], the first the author of a history of the wars which preceded the peace of Westphalia.

QUMPERLE′. [FINISTERE.]

QUIN, JAMES, was born in King Street, Covent Garden, on the 24th of February, 1693. His ancestors were of an antient English family, but his father had been settled in Dublin, and his grandfather, Mark Quin, was lord-mayor of Dublin in 1676. There is no account of his mother in any of his biographies; and in 1710, when his father died, James Quin was unable to prove his legitimacy. He was intended for the bar, and educated in Dublin by Dr. Jones of that city. At the age of twenty he came to England, and took chambers in the Temple, but finding his means after his father's death inadequate to his support, he turned his thoughts to the stage, for which profession he possessed many important qualifications, an expressive countenance, a majestic figure, a powerful eye, and a clear, full, and melodious voice. He was introduced by Ryan, the actor, to the managers of Drury-Lane Theatre, and engaged, in 1717, to appear in the course of the ensuing winter. A tavern brawl, connected with an intrigue, involved him in law proceedings, and he was compelled for a short time to retire to Ireland. On his return to London he made some sensation in the part of Bajazet, at Covent Garden; and in 1720 made his first great hit in the character of Falstaff. He was considered at the head of his profession till Garrick made his appearance, of whom he at first spoke contemptuously.

In 1746 these two great rivals performed together in the 'Fair Penitent,' and in 1748 Quin retired from the stage, but annually performed Falstaff for the benefit of his old friend Ryan, till the year 1754, when, having lost two of his front teeth, he declined appearing, declaring that he 'would whistle Falstaff for no man.' Quin died at Bath, on the 21st of January, 1766. He was a master of elocution, and was engaged in that capacity by Frederick, Prince of Wales, to instruct his son Prince George, afterwards George III. Quin's exclamation of 'I taught the boy to speak,' on hearing his majesty deliver his first speech from the throne, has been quoted more frequently than any of his jokes, although both for number and humour they would of themselves form a capital jest-book. He was a great epicure, and his manners were sometimes coarse and overbearing; but it should never be forgotten that he released Thomson, the author of the 'Seasons,' from a spunging-house by paying the debt and costs for which the poet was incarcerated, without having had any personal acquaintance with him. A full-length portrait of Quin, in a splendid suit of scarlet and gold, is amongst the collection of the late Mr. Mathews, at the Garrick club.

QUINA or **QUINIA,** a most important vegetable alkali, contained in the three well-known varieties of Cinchona, or bark, but principally in the yellow bark. This alkali was discovered in 1820, by Pelletier and Caventou, and they showed the process for obtaining it in its separate state. This alkali may be obtained from yellow bark by a process similar to that already described for procuring Cinchonia [CINCHONIA] from pale bark. It exists combined with excess of kinic acid, forming superkinate of quina. We are inclined to believe that the best process, with some slight modifications, is that proposed in the last edition of the *Edinburgh Pharmacopœia*, 1840. This consists in boiling the bark in a solution of carbonate of soda, so as to extract its colouring and resinous matter, treating the residue with sulphuric acid so as to obtain sulphate of quina, which is to be decomposed by carbonate of soda, and the precipitated quina being redissolved in sulphuric acid and water, and treated with animal charcoal, is to be evaporated to its crystallizing point.

The best method of preparing pure quina is to decompose a solution of the pure sulphate, or rather disulphate, of quina by ammonia, and to wash and dry the precipitate. Its properties are, that it is colourless, inodorous, and extremely bitter. It fuses at about 300° Fahr., and when cold is yellow, translucent, friable, and somewhat like resin. Boiling water dissolves only 1-200th of its weight of quina, and cold water a much less quantity. It is readily dissolved by alcohol, and when a solution in alcohol of sp. gr. 0·815 is set to evaporate spontaneously in a warm place, crystals of hydrate of quina are obtained, containing one equivalent of water. The alkaline property of quina is shown by its restoring the blue colour of reddened litmus, and by saturating and forming crystallizable salts with acids. Quina is soluble in æther, and slightly also in the volatile and fixed oils when they are heated. When subjected to a strong heat with access of air, it is totally dissipated, with the formation of the vapour of carbonate of ammonia; and if there be any residue after the action of the heat is over, it is owing to some impurity.

Quina is composed of—

Twelve equivalents of hydrogen	12	or	7·4
Twenty equivalents of carbon .	120	,,	74·0
Two equivalents of oxygen .	16	,,	9·9
One equivalent of azote .	14	,,	8·7
Equivalent	162		100·0

We shall mention a few of the more important salts of quina, premising that the only one extensively employed is the disulphate, the *Quinæ disulphas* of the London Pharmacopœia, and the *Quinæ sulphas* of the Edinburgh.

Sulphate of Quina.—This salt may be prepared by crystallizing a solution of sulphate of quina, the acid of which has not taken up as much of the alkali as it is capable of combining with. This salt crystallizes in square prisms, effloresces when exposed to the air, is soluble in 11 times its weight of water at 55°, and in 8 times at 72°; it is also dissolved by alcohol. At 212° it fuses in its water of crystallization. This salt, though neutral in composition, is acid to litmus paper, but not sour to the taste. By the action of heat in the air it is totally decomposed and dissipated.

It is not employed in medicine, and is composed of—

One equivalent of sulphuric acid . .	40	or	14·6
One equivalent of quina . .	162	,,	59·1
Eight equivalents of water . .	72	,,	26·3
Equivalent	274		100·0

Disulphate of Quina.—This is prepared by adding the alkali to the acid till it is incapable of combining with more. The crystals of this salt are colourless, acicular, have a pearly lustre, a bitter taste, and effloresce when exposed to the air; one part requires for solution about 740 parts of cold or 30 of boiling water, 80 of cold alcohol of sp. gr. 0·850, and much less of boiling. When heated, disulphate of quina becomes luminous, fuses, and on cooling has the appearance of melted wax; it afterwards reddens, begins to decompose, and when the heat is raised to ignition in the air, charcoal is obtained, and this, if the salt is pure, is eventually entirely dissipated without residue. It is one of the remarkable properties of this salt to give a blue tinge to water; by the addition first of chlorine, and then of ammonia, it becomes of an emerald green colour.

It is composed of—

One equivalent of sulphuric acid	40	or	9·17
Two equivalents of quina . .	324	„	74·31
Eight equivalents of water .	72	„	16·52
Equivalent	436		100·00

Nitrate of Quina.—When the solution of this salt is evaporated to a certain point, oleaginous drops are formed, which resemble wax in appearance when they have solidified. When they are kept some days under water, they gradually alter in appearance, and are converted into groups of regular brilliant crystals, and it often happens that one drop becomes a single crystal. This phenomenon depends upon the circumstance that the salt when deposited hot is fused, and contains no water of crystallization, but gradually combines with it to form crystals; the crystals are rectangular prisms with inclined bases, and do not possess any cleavage.

Hydrochlorate of Quina.—This salt crystallizes in silky or pearly tufts. It is slightly soluble in water, but more so than the neutral sulphate of quina. It fuses below 212°. There are probably two hydrochlorates, corresponding to the two sulphates of this alkali; the neutral salt consists of—

One equivalent of hydrochloric acid	37
One equivalent of quina . .	162
	199

Oxalate of Quina.—This salt is obtained by precipitating a soluble salt of quina by a neutral oxalate; it is procured in the state of a white powder, which is but slightly soluble in water when cold, but more soluble in boiling water, and as the solution cools, the salt is deposited in silky crystals. It is very soluble in alcohol, especially when heated, and the salt crystallizes as the solution cools. When excess of acid is added to the oxalate, it dissolves readily in water, and crystallizes in needles.

Gallate of Quina.—This salt precipitates in the state of a white powder, when a soluble gallate is added to a solution of a salt of quina. It is soluble in hot water, but precipitates as the solution cools; it dissolves readily in excess of acid and in alcohol. This salt is produced when infusion of galls is added to infusion of yellow bark.

Kinate, or rather *Superkinate of Quina*, is the salt which exists naturally in the bark. It is crystalline, and may be obtained by spontaneous evaporation in mammellated white crusts, which sometimes consist of small needles that lose their transparency by exposure to the air, and assume a horny appearance. This salt is very bitter, slightly soluble in alcohol, but very soluble in water.

The salts of quina in general are distinguished by their strong taste of Cinchona, and by their pearly lustre; the greater number are soluble in water, and some are soluble also in alcohol and æther. The soluble salts are precipitated by the oxalic, tartaric, and gallic acids, by the salts of those acids, and also by the alkalis and alkaline earths.

QUINAULT, PHILIPPE, born at Paris in 1635, studied the law, and afterwards followed it as a profession for a time, but owing to his inclination to poetry, he neglected it, and began to write for the stage. He wrote several tragedies and comedies for the Théâtre Français, which are now forgotten. About 1673 he began writing plays for the Grand Opera, which his friend Lulli set to music [Lulli]; and it is on this kind of composition, which partakes strongly of the lyric, that Quinault's reputation as a poet was established. He is considered the first writer of French operas; the attempts made before his time by Perrin were below mediocrity. A. W. Schlegel observes that 'Quinault, though now almost forgotten, is nevertheless highly distinguished for his lyric tragedies;' and the same critic adds that he prefers his manner and style of composition, light, animated, and fantastic, to that of the great Italian melodramatist Metastasio. The opera of 'Armide' is considered Quinault's masterpiece. Louis XIV. bestowed on Quinault the order of St. Michael, with a pension of 2000 livres, and the French Academy and the Academy of Inscriptions and Belles-Lettres numbered him among their members. At Lulli's death, in 1687, Quinault ceased to write for the stage, and he died the following year, leaving a considerable fortune among his daughters. All his dramas have been collected and published: 'Le Théâtre de M. Quinault, contenant ses Tragédies, Comédies, et Opéra, édition augmentée de sa Vie, et d'une Dissertation sur ses Ouvrages et sur l'Origine de l'Opéra,' 5 vols. 12mo., Paris, 1715.

QUINCE. The fruit so called is the *Cydonia vulgaris* of botanists, of which there are three varieties, the apple-shaped, pear-shaped, and the Portugal quince. The last is by some reckoned a species. There are also some sub-varieties of the others. The quince-tree is used, and chiefly propagated in this country, for furnishing stocks for grafting with such pears as are intended to be grown as dwarfs, or when early fruiting is desired. The Portugal quince is to be preferred for this purpose, as its growth corresponds nearer with that of the pear than the other smaller-leaved sorts. It is also better for the domestic purposes to which the fruit of the quince is applied, such as marmalade and syrups or jellies. The propagation of the trees is easily effected by layering. As the tree vegetates early, it should, when used as a stock, be grafted as soon as the weather will permit. From this not being attended to, a want of success has occasionally been complained of. The stocks should be headed down even as early as January. Quinces are best adapted for light and rather moist soils. In dry soils the pears grown upon them are rendered gritty. [Cydonia.]

QUINCTILIA'NUS, MARCUS FA'BIUS, is said by Jerome (*Chron. Euseb.*) to have been a native of Calagurris (Calahorra), a town in the northern part of Spain, and to have been brought to Rome by Galba, on the death of Nero, A.D. 68. There is however sufficient evidence in the works of Quinctilian to prove that he was educated if not born at Rome; and it is certain that he must have lived at Rome at least as early as A.D. 59. He describes himself as an adolescentulus (*Orat. Inst.*, v. 7, p. 271, ed. Bipont) and juvenis (*Id.*, x. 1, p. 212) when he heard Domitius Afer, who died, according to Tacitus (*Ann.*, xiv. 59), in that year. Dodwell, in his 'Annales Quintilianei,' maintains that Quinctilian was born at Rome in the beginning of the reign of Claudius, about A.D. 42, and accounts for the statement of Jerome by supposing that Quinctilian accompanied Galba to Spain, and returned with him to Rome on the death of Nero. That Quinctilian was not born in Spain is confirmed by the fact that Martial, who was himself a native of Spain, and speaks of most of his fellow-countrymen who were in any way eminent, never mentions Quinctilian as such; in addition to which, Quinctilian himself speaks of his father as if he had been an orator at Rome (*Inst. Orat.*, ix. 3, p. 169). It is thought by some writers that M. Seneca alludes either to the father or grandfather of Quinctilian, in the fifth book of his 'Controversiæ' (*Præf.*, p. 327, ed. Bipont).

Jerome says (*loc. cit.*) that Quinctilian was the first rhetorician who received a salary from the fiscus, which must have been first given him in the time of Vespasian. (Suet., *Vesp.*, 18.) He practised as an advocate with great reputation (*Orat. Inst.*, ii. 12, p. 114), and also taught rhetoric for twenty years (*Id.*, Præf. in lib. i.), to both of which occupations Martial alludes in an epigram (ii. 90) addressed to him:—

> 'Quinctiliane, vagæ moderator summe juventæ,
> Gloria Romanæ, Quinctiliane, togæ.'

After retiring from his profession, he was entrusted by Domitian with the education of the nepotes of his sister (*Inst. Orat.*, Præf. in lib. iv., p. 210), and about the same time wrote his great work on the education of an orator. We are ignorant of the time of his death; Dodwell supposes that he lived till the beginning of the reign of Hadrian, and that this emperor bestowed upon him the consular ornaments, which we know were granted to him at some period of his life. (Ausonius, *Grat. Actio*, p. 290, ed. Bipont.) Juvenal (vii. 192) also speaks of his being a senator.

In the preface to the sixth book of his work on the instruction of an orator, Quinctilian bitterly laments the death of his wife and two sons, and complains that there was no providence in the government of human affairs. His wife died in her nineteenth year, and his younger son in his fifth, soon after the death of his mother. The elder lived to the age of ten, and died while Quinctilian was engaged in his great work. It appears however that he mar ried again, or that he had a daughter, whom he has omitted to mention; since Pliny the Younger, in a letter to Quinctilian (*Ep.*, vi. 32), speaks of a daughter of his, who was to be married to Nonius Celer.

Quinctilian was the most celebrated teacher of rhetoric in his time. The younger Pliny was one of his pupils (*Ep.*, vi. 6), as well as many other eminent men.

Quinctilian complains that many works had been published under his name without his consent. He particularly mentions two books on the art of rhetoric, which had been taken down by his pupils and afterwards published from their notes (*Inst. Orat.*, Præf. in lib. i.); and he also says that several of his speeches were published in the same way from the notes of the shorthand writers (vii. 2, p. 21). According to Juvenal (vii. 186, &c.), Quinctilian acquired great wealth by his profession, but Pliny (*Ep.*, vi. 32) speaks of him as in moderate circumstances. Juvenal however appears to speak of his wealth in comparison with other rhetoricians, while Pliny perhaps compared it with his own fortune.

Quinctilian's work on the education of an orator ('Institutio Oratoria') was written, as already stated, in the reign of Domitian, upon whom he bestows the most extravagant flattery in the preface to his fourth book, and invokes his assistance as a god in the composition of the work. It is dedicated to Marcellus Victorius, whose son he had educated, and it was undertaken chiefly for the instruction of his own son, who died before it was finished. (*Præf.* in lib. vi., p. 342.) It is divided into twelve books, and its object is not merely to give the chief rules of the art of rhetoric, but also to point out the course of education which an orator should pursue. He gives an outline of the whole work in the preface. The first book, he says, treats of those subjects which must be studied before rhetoric. In the second, the elements of rhetoric are discussed; and in the five following *inventio*, in which *dispositio* is included. Elocutio, memory, and pronunciation form the subject of the four next; and the last is devoted to a discussion of the qualifications necessary for an orator, and of the manner in which causes should be pleaded.

The first book is perhaps the most interesting to us, as it gives us some knowledge of the manner in which a respectable Roman youth was educated. Quinctilian commences by saying that the education of the orator should begin from his infancy, and recommends that the nurses and all persons about the child should have a correct pronunciation. He says that it is better to learn Greek before Latin, as the latter will be easily acquired from its being the language of the country; but he disapproved of the plan adopted by many of only allowing Greek to be spoken for a long time, since thereby the child acquired the Greek accent and Greek idioms in speaking his own language. He recommends a public school in preference to home education, as the emulation of public schools is sufficient to counterbalance any disadvantage arising from the number of the boys and the consequent inability of the master to give them his undivided attention, as in the case of a single pupil; and he replies at some length to the objection that public schools are injurious to morals, and maintains that a boy incurs as much danger of having his morals injured at home as at school. He recommends the master however to study well the disposition of each boy, and he strongly disapproves of corporal punishment. At the grammar-school, the pupil is to learn the art of speaking correctly, and also to study the antient authors, beginning first with the poets, and afterwards proceeding to the historians. Before going to the school of the rhetorician, the pupil must acquire a knowledge of music and geometry; and he also recommends him to receive some instruction in pronunciation from the comic actors, and in gesture and attitude from the masters in the Palæstra.

After passing through this course of education, Quinctilian considers the pupil competent to enter the school of the rhetorician, and accordingly in his second book he gives the first elements of the art of rhetoric. He thinks that the pupil should not attempt to speak extempore at first, but should confine himself to written exercises, which should first consist of narrations of real facts, and afterwards of panegyrics of illustrious men and dispraise of the wicked. After recommending some other subjects for written compositions, he points out the advantages attending a careful study of the best historians and orators under a master, who would point out their principal beauties and defects. In choosing subjects for declamation, he condemns the practice, which was common in his time, of taking them from the works of the poets, the answers of oracles, &c., and maintains that they should be confined as much as possible to such matters as the orator would afterwards be engaged upon in the courts. At the conclusion of the book he defines rhetoric to be the art of speaking well, and proves that it ought to be regarded as an art and a virtue (virtus), and that it comprehends all subjects which can be discussed.

The first two books are only introductory; in the third Quinctilian commences the principal subject of his work, namely, the art of rhetoric. He says that it consists of five parts, *Inventio*, *Dispositio*, *Elocutio*, *Memoria*, *Pronuntiatio* or *Actio*. He divides all causes into three kinds, the *Demonstrative* or *Panegyrical*, the *Deliberative*, and the *Judicial*. The demonstrative or panegyrical treats of subjects requiring praise (*laus*) or blame (*vituperatio*), and is frequently employed by the orator, as in funeral orations, recommending or attacking witnesses, &c. The deliberative consists of persuasion (*suadendi*) and dissuasion (*dissuadendi*), and is confined by Greek writers to speeches made in the assemblies of the people; but, according to Quinctilian, may be employed in many other speeches. The judicial consists in accusation (*intentio*) and defence (*depulsio*), and is divided by Quinctilian into the prooemium, narratio, probatio, refutatio, and peroratio. All suits, Quinctilian says, are respecting one thing or more than one. The former are called *simplices*, as in the case of theft, adultery, &c.; and the latter *conjunctæ*, as in the case of extortion (pecuniæ repetundæ), or when a person is accused of more than one crime at the same time. He also says that there is another species of law-suits, called the *comparative*, as for instance when the matter in dispute in the court of the Centumviri is, which claimant is more worthy of the inheritance; or when, in the case of a divinatio, it has to be decided who is to be the real or chief accuser; or when two informers both claim the reward.

In the fourth and fifth books Quinctilian treats of the prooemium, narratio, probatio, and refutatio, in judicial causes; and remarks, that the probatio is the most important. He divides proofs into *inartificial* and *artificial*: under the former he includes previous judgments (præjudicia), common reports (rumores), torture of slaves (tormenta), legal instruments (tabulæ), oaths (jusjurandum), and witnesses (testes); by artificial proofs he means those which the orator brings forward from the subject, and to a certain extent invents himself. Præjudicia, says Quinctilian, consist of three kinds: 1st, *exempla*, or precedents, that is, similar cases, which have been already decided; 2, *judicia* which have been passed on matters relating to the cause; and 3, *judicia* which have been already given on a previous trial of the cause. Witnesses, Quinctilian says, give their testimony in writing (per tabulas) or by word of mouth in open court; and he discusses at considerable length the best modes of examining and cross-examining witnesses.

In the sixth book Quinctilian treats of the peroratio in judicial causes; and in the seventh, of the dispositio, the second of the five parts into which he divided the art of rhetoric. He defines dispositio to be a proper distribution of the different materials and parts of a speech into their proper places.

In the eighth book he treats of what he calls elocutio, which, he says, all orators consider to be the most difficult part of their art. He recommends the orator to pay more attention to the argument of his speech than to the mere words which he should use; and maintains that those words are the best which best express our meaning, and produce in the minds of the judices the effect that we desire. He then proceeds, in the remainder of this book and in the three following, to explain all the different subjects comprehended in elocutio, as perspicuity, ornament, amplification, metaphors, &c., and gives directions for acquiring the art of extempore speaking. In the latter part of the eleventh book he briefly discusses the fourth and fifth branches of rhetoric, namely, memory and pronunciation.

In the twelfth book he treats of the qualifications necessary for an orator, and maintains that no one who is not virtuous can be a perfect orator; and that a knowledge of philosophy, civil law, and history is necessary to the orator. He also gives some general directions respecting the manner in which causes should be studied and pleaded in court; and points out the kind of eloquence which the advocate should use.

The first complete MS. of the 'Institutes' of Quinctilian was discovered in the year 1417, by Poggio [Bracciolini], in the monastery of St. Gall, which is about twenty miles from Constanz. Poggio has given an interesting account of the discovery of this MS. in a letter to Guarinus, which is reprinted in Fabricius's 'Bibliotheca Latina,' edited by Ernesti (vol. ii., p. 259). On the revival of learning, the Institutes of Quinctilian were studied almost more than any other Latin author, and lectures on rhetoric were at that time confined to an interpretation of Quinctilian's work, which accounts for the number of editions which were published in the fifteenth and sixteenth centuries. The professor in the university of Leipzig, who is now called professor eloquentiæ, formerly had the title of Quinctiliani professor.

Besides the Institutes, there are certain Declamationes which are usually published under the name of Quinctilian. Of these there are nineteen of considerable length, and one hundred and fifty-four much shorter, which are said to have originally consisted of three hundred and eighty-eight. The latter were probably written by a different person from the author of the former, and neither of them by Quinctilian himself. Quinctilian tells us that he only published one oration himself. (*Orat. Inst.*, vii. 2, p. 21.) Some modern writers suppose that the shorter Declamations were published by Quinctilian's father, who is spoken of by his son as an orator (ix. 3, p. 169), or by the Quinctilian mentioned by Seneca (*Controv.*, Præf. in lib. v.); but there are no sufficient reasons for either opinion.

Quinctilian also wrote a work on the causes of the corruption of eloquence (*De Causis Corruptæ Eloquentiæ: Orat. Inst.*, Præf. in lib. vi., p. 343), which some critics imagine to be the work entitled 'De Oratoribus, sive de causis corruptæ eloquentiæ dialogus,' which is usually printed with the editions of Tacitus. The latter work however could not have been written by Quinctilian, as we find him saying, at the end of the eighth book of his Institutes, that he had treated fully the subject of hyperbole in his work 'De Causis Corruptæ Eloquentiæ;' whereas the subject is not mentioned in the 'Dialogus de Oratoribus.' Respecting the author of this work see Tacitus.

The best critical edition of Quinctilian's Institutes is by Spalding, Leipzig, 1798-1816, 4 vols. 8vo., to which an additional volume of notes was added by Zumpt, Leipz., 1829, 8vo.; and a Lexicon Quintilianeum, by Bonellus, Leipz., 1834, 8vo. The editions of the Institutes by Lünemann, Hannov., 1826, 2 vols. 8vo., and Zumpt, Leipz., 1831, 8vo., may also be recommended. The best editions of the Institutes and Declamationes together are by Burmann, Leyden, 1720, 2 vols. 4to.; and the Bipont, 1782, 4 vols. 8vo. There is also an edition of the Institutes and Declamationes by Dussault, Paris, 7 vols. 8vo.

The Institutes have been translated into English by Guthrie, Lond., 1756, 2 vols. 8vo., and Patsall, Lond., 1774, 2 vols. 8vo.; into French by Mich. de Pures, Paris, 1663, 4to., and Nic. Gedoyn, Paris, 1718, 4to.; and into German by Henke, Helmst., 1775-1777, 3 vols. 8vo., of which a new edition was published by Billerbeck, Helms., 1825, 3 vols. 8vo.

For further information respecting the life of Quinctilian, the reader is referred to Dodwell's 'Annales Velleiani, Quinctiliani, Statiani, s. vitæ C. Velleii Paterculi, M. Fabii Quinctiliani, P. Papinii Statii, pro temporum ordine dispositæ,' Oxon., 1698, 8vo.

QUINCY. [Massachusetts.]

QUINDECAGON, a figure of fifteen sides.

QUINSY, or Cynanche, or Angina, is an inflammation of the throat. Nosologists, having applied the name of cynanche to nearly all the inflammatory diseases in this part, have been obliged to distinguish the different affections of the several organs included in it, by specific names; hence we have cynanche parotidæa, another name for mumps; C. trachealis, which is croup; C. pharyngea, or inflammation of the pharynx; C. tonsillaris, or inflammation of the tonsils; and many other species, named either from the organ chiefly affected, or the character of the inflammation. Of these, mumps and croup having been treated of in separate articles, the present may be devoted to the two last mentioned, which are indeed those that are commonly intended by the popular name quinsy.

Cynanche pharyngea, or inflammation of the mucous membrane lining the back of the mouth and the upper part of the throat, is that which usually exists in a common sore-throat, brought on, as it most frequently is, by a change in the weather, or by sitting in cold or damp air. It is usually mild disease, and chiefly annoying from its liability to recur on slight occasions. The extent of the inflammation varies greatly in different cases; it may be confined to the pharynx, or it may spread from it over the soft palate and the tonsils, and into the cavities of the nose, where it produces the additional symptoms of a cold, or into the tympanum [Ear], giving rise to deafness. On examination, the back of the mouth and fauces, when thus inflamed, will be found unnaturally red and swollen, and often covered with tough mucus or lymph; and from these changes there result dryness and soreness of the throat, pain on swallowing, and a sensation as if the diseased parts were closely constricted.

A common sore-throat does not need much treatment; warmth, gentle purgatives, and sweating medicines, the avoidance of stimulating food, and the inhaling of the vapour of hot water, or hot vinegar and water, or the application of a large poultice round the throat, will usually effect its removal in a few days. Sometimes however the disease is prolonged in a slight but obstinate form, which is commonly called a relaxed sore-throat. In this condition the redness of the parts affected is still observed, but it is of a less vivid colour, and is irregularly streaky, instead of being evenly diffused; the velum also, which is commonly implicated, is elongated, and it is from its unnatural contact with the back of the tongue and the epiglottis that the tickling sensation in the throat arises, and excites a constant desire to swallow or to cough. For this condition the necessary treatment consists of stimulating gargles, such as hot wine, infusion of Cayenne pepper, very diluted mineral acids, &c., and if the patient be in general ill health, tonics and appropriate alteratives.

In more severe cases of inflammation of the pharynx and adjacent parts, matter sometimes forms either around or near the pharynx, or in the soft palate or the uvula. Wherever the existence of matter can be determined, it should be immediately let out, as from an abscess in any other part of the body. In other severe, and in some measure peculiar, cases, the intensity of the inflammation is marked by the formation of false membranes on the affected surface. This form of the disease has been named angina membranacea, and has been especially described by M. Bretonneau and other French physicians under the name of *diphtherite*. In its essential nature this affection resembles croup, with which also it is sometimes connected, the false membrane being not only spread over the mucous surfaces of the pharynx and fauces, but extending down into the trachea. In some cases the inflammation is very acute, and, being accompanied by common inflammatory fever, requires for its reduction the most active antiphlogistic treatment; the same measures, in short, as are applicable in cases of croup. [Croup.] In another severe form of quinsy, the inflammation and formation of false membranes are accompanied by a low typhoid state with great prostration of strength, and requiring all the remedies that are used in cases of low typhus fever, in malignant scarlet fever, and other dangerous diseases of the same class. It is this form of disease which is usually called putrid or malignant sore-throat, and by nosologists, cynanche or angina maligna. It sometimes occurs as an epidemic, and was long regarded as attended by sloughing of the throat, the layers of false membrane being mistaken for the inflamed tissue in a state of gangrene.

In cynanche tonsillaris or tonsillitis, the inflammation is entirely or nearly limited to the tonsils. Its symptoms are scarcely distinguishable from those of the common form of the preceding disease, but on examining the throat the redness is seen to be less diffused, and the tonsils, being more or less increased in size, are approximated to each other so as nearly to block up the posterior aperture of the mouth, and render any effort to swallow extremely painful. Hence, to avoid the pain, the patient usually lets the saliva flow from his mouth, and often, in attempting to swallow, is unable to overcome the obstacle presented by the enlarged tonsils, and discharges the fluid back through the nose. In many cases also the inflammation extends to the eustachian tube and tympanum [Ear], producing deafness, and to the parts immediately around the larynx, giving rise to difficulty of breathing and a harsh hoarse sound of the voice. With these local symptoms there is usually more or less fever, with headache, loss of appetite, &c.

The milder cases of inflammation of the tonsils may be treated in the same manner as those of the preceding disease; leeches applied to the sides of the throat where the pain is most severely felt, are probably the most beneficial means that can be employed. With a higher degree of inflammation abscesses often form in the tonsils, accompanied by all their usual signs, and with still greater obstruction in the throat. In time these will break of themselves, but it will materially shorten the patient's sufferings if they be opened as soon as matter has distinctly collected. The operation should be performed with a guarded knife, or with one that slips through a canula and can have the length of its cutting part fixed.

The most annoying result of repeated inflammation of the tonsils (and those who have once suffered are peculiarly liable to a recurrence of the disease from very slight causes), is, that they become permanently enlarged. In this state, although swallowing is not painful, it is often attended with difficulty, and by the partial closure of the fauces the respiration is always obstructed and requires an effort for its effectual performance. From this, in children, a peculiar deformity of the chest often results, the breast-bone and the fronts of the ribs becoming elevated and very much arched forwards, in a form which is commonly called chicken-breasted. But if this do not occur, the patient always suffers inconvenience from hoarseness and a kind of nasal sound of the voice; he cannot avoid snoring very loud in his sleep, and often starts up from it with a feeling of impending suffocation. The best means for the removal of this state are astringent gargles, as those with alum, oak-bark, mineral acids, &c. Iodine also, administered internally and rubbed on the throat, often proves useful; but in many cases nothing will alleviate the condition of the patient but cutting off a portion of each tonsil, so as to reduce them to their natural dimensions.

QUINTAL generally means the weight of a hundred pounds; but the term is not now English.

QUINTILE, a term of astrology and antient astronomy, meaning distant in longitude by 72 degrees, or the fifth part of the whole great circle.

QUINTIN. [Côtes du Nord]

QUINTUS CA'LABER, a Greek poet, who owes his name of Calaber merely to the circumstance that towards the close of the fifteenth century Cardinal Bessarion discovered his poem in the library of a monastery at Otranto in Calabria. The poet in his own work (xii. 304, &c.; comp. iii. 233; i. 295; x. 128: Tzetzes, *Chil.*, ii. 489, &c.) calls himself a native of Smyrna, and describes himself as having in his youth been a shepherd in the neighbourhood of this city. Hence he is more properly called Quintus Smyrnæus. The original MS. bears only the name of Kointos, and it has been supposed that this is not the name of the author, but of the person to whom the MS. belonged. Under such circumstances it is not to be expected that anything respecting his life and the time in which he lived should be known, beyond what can be inferred from the character of the work itself and some allusions which occur in it. Some scholars, led away by single beauties in the work, and the richness of expression and imagery, have ascribed it to Homer himself, or some of the cyclic poets, while others have conceived him to have been a contemporary of Augustus. The most probable opinion however is that he lived in the fifth century of our æra, in the reign of the emperor Zenon or Anastasius, and that he was a contemporary of Tryphiodorus and Coluthus, whose poems were contained in the same MS. in which that of Quintus was discovered. In confirmation of this opinion we may refer to lib. xii., 335, &c., where Calchas is represented as foretelling the greatness of Rome, in a manner which can only apply to the latter period of the Roman emperors (comp. vi. 533).

His poem, which is called 'Homeri Paralipomena,' or 'Posthomerica' (for the original MS. has no title), contains in fourteen books those events of the Trojan war which are not described in the Iliad, and it is intended to be a completion and continuation of Homer. The source from which the poet derived his materials are chiefly the so-called cyclic poets. In style and language he imitated the Homeric poems; but an accumulation of *single* beauties, and the deficiencies of the work as an artificial whole, betray the age of the author.

There are several MSS. of the poem of Quintus, but all seem to be more or less correct copies of that discovered by Bessarion. The first edition of Quintus, together with Tryphiodorus and Coluthus, was printed at Venice by Aldus (about 1505). A new edition, with a Latin translation by Rhodomannus, appeared in 1604, at Hanover. In the edition of De Pauw (Lugd. Bat., 1734) the translation of Rhodomannus was reprinted. In 1783, Tychsen published a very good dissertation on Quintus and his poem, which was followed in 1807 by a new and much improved edition of the text of the 'Posthomerica' of Quintus Smyrnæus. The second volume, which was to contain the commentary, has never been published. The poem of Quintus has been translated into French by R. Tourlet (Paris, 1800, in 2 vols.). In 1821 there appeared at Oxford 'Select Translations from the Greek of Quintius Smyrnaeus,' by Alexander Dyce. (Compare Spitzner, *Observationes critic. et grammat. in Quinti Smyrnæi Posthomerica*, Lipsiæ, 1837.)

Besides the 'Posthomerica,' Brunck (*Analect.*, ii., p. 475) attributes to Quintus some verses in the 'Labours of Hercules.'

QUINTUS CU'RTIUS RUFUS. Nothing whatever is known from extrinsic evidence of the personal history of Quintus Curtius or of the time when he lived; nor is there a single passage in his work from which anything can be deduced with certainty. A passage in the tenth book (c. 9) appears to allude to some great calamity that had threatened the Roman state, and which had been averted by the emperor (princeps suus); but the name of the emperor is not stated. In the absence of all proof, it has been supposed that this Curtius may be the rhetorician of whom Suetonius is said to have treated, though that part of his work on rhetoricians is not extant; or that he may be the Curtius who was praetor and proconsul of Africa under Tiberius. (Tacit., *Ann.*, xi. 20.) Cicero also speaks of several persons of the name of Curtius, and he names one of them Quintus. But there is no proof that any of these persons is the Curtius who wrote the 'History of Alexander,' though the rhetorical style of the work would justify us in assigning it with some degree of probability to a rhetorician. One of the best examples of the declamatory style of Curtius is the well known speech of the Scythian ambassadors to Alexander (vii., c. 8).

The work of Quintius Curtius is entitled 'De Rebus Alexandri Magni Regis Macedonum,' or the 'Acts of Alexander the Great, King of the Macedonians.' It was originally in ten books, of which the first two are lost; the third book begins with the attack of Alexander on Celænæ. There seems also to be something wanting at the end of the fifth and the beginning of the sixth book; and perhaps there are some omissions in the tenth book also. There are various modern supplements to Curtius, but that of Freinshemius, who has laboriously supplied the first two books, appears to be the best.

The most opposite judgments have been passed on the work of Curtius. Some prefer him to Tacitus, and others place him, as to style, on a level with the writers of the Augustan age. Others again allow him little merit. Considered as an historian of Alexander, he was evidently deficient in essential qualities: he was not a critical writer, and he was very ignorant of geography. His style is perspicuous and easy, though rhetorical and ornate, and if he did belong to a late age (which is at least doubtful), he wrote better than his contemporaries. The work accordingly is much more suitable for elementary instruction than many other Roman writers; for instance, it is in all respects infinitely superior to the wretched collection of biographies which passes under the name of Nepos. Though somewhat diffuse, and not free from affectation of ornament in his style, the narrative of Curtius is clear and connected, neither encumbered with extraneous matter nor interrupted by digressions. Arrian himself does not keep closer to his subject than the Roman historian of Alexander.

The editions of Curtius are very numerous. The earliest are those of Rome, 1470, and of Venice, 1470 or 1471. The edition of Pitiscus, Hague, 1708, 8vo., contains the supplement of Freinshemius and a copious commentary. The translations are almost as numerous as the editions; there are translations into Italian, Spanish, French, German, English, and other modern languages. The first English translation was by Brende, London, 1553, 1561, 1584, 1592, 1614, 4to., 1570, 8vo., and the latest by Digby, London, 1714, 1726, 2 vols. 12mo., revised by Young in 1747.

QUINTUS CLAUDIUS QUADRIGA'RIUS, a Roman historian of the time of Sulla, wrote the 'Annals of Rome,' of which only a few fragments remain, down to the 23rd book, in the shape of quotations found in Aulus Gellius, Nonius, Priscianus, and other antient writers. These fragments were collected and inserted by Antonius Augustinus, bishop of Tarracona, in his 'Fragmenta Historicorum,' Antwerp, 1595. Quintus Claudius was one of the authors whom Livy had before him in compiling his history; and Livy quotes him in his eighth book (chap. 19).

QUIRI'TES. [Rome.]

QUI'SQUALIS, a genus of plants of the natural family of Combretaceæ, which is indigenous in Amboyna, Java, and the Malayan peninsula, and extends into India. The genus is characterised by having a very long slender tube of the calyx, which is 5-fid at the mouth. Petals 5, oval, oblong, larger than the teeth of the calyx. Stamens 10, exserted, inserted into the faux of the calyx; the alternate ones shorter. Ovary ovate, oblong, 4-valved. Style filiform, obtuse. Drupe dry, 5-angled, 1-seeded. Shrubs with climbing branches. Leaves opposite, seldom alternate, entire, ovate. Spikes axillary and terminal. Flowers change in colour from white to red. The few plants of the genus are cultivated in this country with great ease in moist stove-houses in a mixture of loam and peat. *Q. Indica* is the most common species; its fruit is reckoned a vermifuge.

QUITCH. [Couch Grass.]

QUITO, the capital of the republic of Ecuador in South America, is situated in 0° 14′ S. lat. and 81° 50′ W. long., at an elevation of 9534 feet above the level of the sea. This great elevation, and its position near the equator, render the climate very mild all the year round, and it may be compared with our finest spring weather. The temperature of the air at noon generally varies between 60° and 67°, and that of the coldest part of the night between 52° and 56°. In a few cases the thermometer has risen to 79°, and has descended to 45°. The mean annual temperature is 59°, which corresponds to that of the month of June in London. A small portion of the town is built on level ground, and the remainder on the declivity of a hill. The plain contains the great square, which is surrounded by public buildings. The cathedral and the episcopal palace stand opposite to one another, and the other two sides are occupied by the palace of the government and the town-hall. The square itself is spacious, and has an elegant fountain in the centre. Four wide and straight streets branch off from the four angles of the square, but they are short, and extend only to the foot of the hill. The remainder of the town is built on the lower declivities, which are furrowed by numerous ravines, some of which are of considerable depth. This circumstance renders the streets very uneven and irregular. Some parts of the city are at the bottom of the ravines, while others occupy the sides and eminences. The larger streets are paved, and the others, which are not paved, are almost impassable after rain, which is very frequent. There are some smaller squares, on which the convents are built, among which that of the Franciscans is a vast edifice, which is both magnificent and tasteful. The greater part of the houses are built of bricks dried in the sun; and in order that they may suffer less from the frequent earthquakes, they are only one story high. The roofs are flat, and are covered with the leaves of the maguey (*Agave Americana*). The interior of the houses is very simple, the saloon for receiving visitors being the only one which is ornamented, and even that is rather scantily furnished. The more wealthy classes inhabit the upper part of the houses, and the common people live on the ground floors. There are only three public fountains in Quito; few of the private houses are provided with fountains, and the water is generally bad. Quito is the seat of the legislature and general government of the republic of Ecuador, as well as of the provincial government of the department of Ecuador. It has a university and two colleges for the instruction of the clergy. There is a large establishment appropriated for the maintenance of orphans and poor people, which is well managed. The surrounding country is not very pleasant for want of trees, but the scenery is very grand, as eleven snow-capped summits are visible from the town. The population was estimated at 60,000 by Ulloa, about a hundred years ago. Caldas, at the beginning of this century, reduces it to 40,000. There are some manufactures of cotton, silk, and leather, and silver and gold are worked rather extensively. (Ulloa's *Voyage to South America*; and Caldas, in the appendix to Mollien's *Travels in Columbia*.)

QUO WARRANTO is a writ in the nature of a writ of right for the king, and it lies against any person or corporation that has usurped or unjustly claims any public office or other franchise or liberty, or that, having originally had a grant of one, has forfeited it by abuse or neglect. Proceedings under it are prosecuted before the judges of the Court of Queen's Bench, and the defendant is called on to show *by what warrant* (*quo warranto*, whence the name of the writ) he exercises the office, liberty, or franchise in question. The first process against him is by summons. If he fail to appear in the same term in which he is summoned, he loses his franchise. After appearance, he may disclaim any title, either to the whole or part of the franchise; or he may plead in justification, showing by what warrant he has exercised it. To this plea there may be either a demurrer or replication, and subsequent proceedings as in ordinary actions. On disclaimer judgment is immediately given for the crown. In that case, or on judgment for the crown on demurrer, or after trial, the judgment is that the franchise shall be seised into the hands of the crown, or, if the crown cannot have the franchise, that the defendant shall be ousted, that is, ejected. If the judgment be for the defendant, it is that he may enjoy the franchise, &c., saving the right of the king, and this saving applies to all titles except that on which judgment is given. The judgment is conclusive even against the crown. (2 *Inst.*, 282; Co., *Ent.*, 527, &c.)

Proceedings under a writ of quo warranto have fallen into disuse, and they have been superseded by informations in the nature of a quo warranto. These informations are adapted to attain the same ends, are applicable to the same circumstances, and are more expeditious, but the judgment under them is not conclusive against the crown. Except when exhibited by the attorney-general, they are filed by leave of the court.

The statute of the 9 Anne, c. 20, was passed for the purpose of regulating and expediting the proceedings under an information of quo warranto, relating to the title to corporate offices the due discharge of which affects the rights or prerogatives of the crown or the interests of the public. Although criminal in their title and form, and having for their ostensible object the punishment by fine, as well as the ejection of a party from his office, these proceedings are virtually of a civil nature; and they are now almost exclusively employed for the decision of questions relative to the exercise of corporate rights between mere individuals. Under this statute an information may, by leave of the court, be filed, in the name of the master of the crown-office, by any party desirous of prosecuting it. Such party is styled the relator. If he be in no way connected with the corporation, that is considered as a reason for refusing the application. (1 East, 46, n.) In order to obtain leave to file an information, the relator must apply by motion in open court, and must support his application by affidavits of all the facts upon which it is grounded. After hearing the application, the court may either grant or refuse a rule nisi. Formerly it seems to have been grantable almost as a matter of course; but that is no longer the case, and the court will never grant a rule where the alleged usurpation might be made the subject of a civil action, or where the office exercised is not one of a public character either actually or in contemplation of law affecting the rights or prerogatives of the crown. For instance, the court will not grant a rule for the purpose of inquiring into the right to exercise the office of churchwarden. (4 *T. R.*, 381.) If a rule nisi be granted, the case comes on for argument in the ordinary course. The defendant may either support his opposition by affidavits stating the facts which form the grounds of it, or confine himself to arguments arising on the case presented by the relator. Where the consequence of giving effect to the objections raised in the information would be wholly to dissolve the corporation, or facts are shown which discredit the motives of the relator, or prove that he has himself concurred in an election which he seeks to set aside, or that the same objections apply to his own title, or where there has not been a user, that is, exercise or possession of the office, the rule would probably be discharged. (2 *T. R.*, 767; 2 B. and Ald., 339, 479.) If however the facts or law of the case be doubtful, a rule will be granted. (3 Burr., 1485.) If the rule be made absolute, the defendant must plead, at latest, within the next term. (6 *T. R.*, 594.) If the plea be insufficient, the court will allow the defendant to amend at any time before trial. In other respects, the pleading is conducted on the same principles as in ordinary cases. If the defendant be found guilty, the court may give judgment of ouster as well as fine. By the statute of Anne, costs are given to the relator against the defendant, if the information be successful; to the defendant against the relator, if it wholly fail. If one material issue be found for the crown, the crown must have judgment, and the relator is entitled to costs on all the issues. (1 *T. R.*, 453.) The provisions of the statute of Anne only relate to offices analogous to those mentioned, that is, those of a corporate character. By the statute 33 Geo. III., c. 58, the defendant in a quo warranto information against a corporate officer is enabled to plead that he had exercised the office in question for six years previous to the exhibition of the information. If the fact be found to be so, the defendant is entitled to the same judgment as if a verdict had been found for him on the merits. This provision was in accordance with a rule which the courts had already laid down upon their own authority. By stat. 1 Vic., c. 78, s. 23, the time within which proceedings of quo warranto may be brought against any mayor, alderman, councillor, or burgess, is further limited to one year after either his election to office or the commencement of his disqualification. (Com., *Dig.*, tit. 'Quo Warranto;' Bl., *Com.*)

QUORRA (or **NIGER**), a river in Africa, the largest in that continent except the Nile. It is not yet determined which of these two rivers has the longer course, as the sources of the Bahr el Abiad, or of the principal branch of the Nile, have not yet been visited by any traveller, and a portion of the source of the Quorra has not been accurately laid down on our maps. There can hardly be a doubt however that the basin of the Quorra is more extensive than that of the Nile.

There is some difference of opinion respecting the source of the Quorra, though all travellers agree in placing it in that extensive mountain-region which, under the name of the Kong Mountains, extends from the coast of Sierra Leone (13° W. long.) to the most eastern bend of the Quorra (7° E. long.). [Kong Mountains.] Mungo Park, who first succeeded in reaching the banks of the Quorra, and who collected much information respecting its course, laid down the source of the river in 11° N. lat. and 6° W. long. Major Laing, who in 1822 visited the countries east of Sierra Leone, was informed, at the place where he was obliged to return, that he had nearly reached the source of the Quorra, and that Mount Loma, in which it originates, was in sight. He determined therefore the source of the Quorra to be in 9° 25′ N. lat. and 9° 45′ W. long. The French traveller Mollien, who visited this part of Africa in 1818, collected other information, according to which the Quorra rises in 8° 20′ N. lat. and in 9° 10′ W. long. This difference may easily be accounted for by observing that many streams rise in a mountainous country, which unite to form a great river, and that each of them may be considered as the source of such a river. As the most western of these tributaries is that of which Major Laing got information, it is properly considered the principal river. It runs near its source due north for about 70 miles, and is there called Timbie. It then turns to the north, and exchanges its name for that of Baba, and Joli-Ba (*i.e.* large river), under which name its course as far as Timbuctoo is known, the name of Quorra being only applied to the lower portion of its course. Caillié crossed the Joliba at Curuassa, about 100 miles from its source, and found that it was navigated by large canoes. It flowed in a wide valley from south-south-west to north-north-east, which was surrounded by hills from 150 to 200 feet high. The soil of the valley was fertilised by the inundations of the river. The mountains in the neighbourhood are rich in iron-ore, and contain gold.

From Curuassa to Bammakoo, a distance exceeding 200 miles, the course of the river is unknown, not having been seen by any European traveller. But that portion of it which lies between Bammakoo (13° N. lat. and 5° 20′ W. long.) and Timbuctoo (18' N. lat. and 3° 40′ W. long.) has been laid down by Mungo Park and Caillié. Mungo Park in his first journey travelled along the banks of the river from Bammakoo to Silla, a distance of about 160 miles. Between Bammakoo and Tabbec the river runs in a north-east direction, in a wide valley which produces good crops of rice, maize, and vegetables, and has good pastures; it is pretty well inhabited, and there are several towns on the banks of the river. At Tabbec the Quorra enters the plain of Súdan, and it runs to the east as far as the town of Jennee. From Tabbec to Silla, the end of his travels, Mungo Park found the country on both sides of the river extremely fertile, well cultivated, and studded with towns of considerable size and many villages. In the rainy season the country to a considerable distance from the river is inundated. The current of the river is moderate, and offers no impediments to navigation, large river boats are frequently seen, both ascending and descending. In his second journey, Mungo Park embarked at Sego, and descended the river more than a thousand miles to the town of Boussa (10° N. lat. and 4′ 40′ E. long.), where his boat was wrecked, and he was killed. Thus the information which he had obtained respecting this part of the course of the river and the countries adjacent to it, was lost to the world. But Caillié has partly supplied the loss. He descended the river from Jennee to Timbuctoo, and found the banks, in some places, well cultivated and rather populous. The general course of the river was north as far as the lake of Debo, and even to some distance farther, but afterwards it turned to the north-north-east, and continued so to the town of Timbuctoo, or rather, to its port Cabra. The river-barges which navigate this part of the river are from 60 to 80 tons burden, and take the produce of the country, rice, millet, corn, honey, butter of the shea-tree, &c., to Timbuctoo and other large places. The crews consist of about 20 men; the boats use no sails. The lake of Debo, through which the Quorra flows, south of 16° N. lat., is of considerable extent; it is perhaps ten miles from south to north, but it occupies a much greater space from east to west. North of the lake, where the river flows to the north-east, cultivation is more general, and the number of villages is greater. Some of them carry on a considerable traffic with Timbuctoo. In approaching Timbuctoo the river separates into two branches, which appear to unite at no great distance farther down. On the smaller and more northern of these branches is Cabra, the port of Timbuctoo. From this place to the town of Yáoorie (11° 10′ N. lat.) the course of the river is not known; but as Mungo Park, when he left Sego, went as far as Boussa, which is about 70 miles farther down the river Yáoorie, it is evident that the Joliba of Timbuctoo and the Quorra of Boussa are the same river. It seems that the Quorra leaves the great plain of Súdan before it reaches the neighbourhood of Yáoorie. From that place to the mouth of the river the Quorra has been navigated by the Landers. Between Yáoorie and Rabba (9° N. lat.) the river runs nearly south, and then it makes a great bend to the east; but before it arrives at 8° N. lat. it again runs south, and by degrees inclines to the west, in which direction it reaches the sea under the name of Nun. That portion of its course which lies between Yáoorie and 7° N. lat. is only navigable during and after the rainy season; at the end of the dry season, the bed of the river is full of rocks, sand-banks, and shoals. In these parts the river runs through a mountainous country, but the valley is low, and annually inundated; it is however very fertile, and villages and cultivation are common. The mountains by which this valley is enclosed rise to a considerable elevation, and with a gentle declivity. Between 8° and 7° N. lat. the lower offsets of the mountains on both banks of the river come close up to the water, and where they recede from it the interval is not very wide. The declivities of the mountains are covered with woods. This narrow valley does not contain so large a population as the wider one farther north. Near Abbazacca (about 6° N. lat.) the river leaves the mountain-region, and enters a low alluvial plain, in which it divides, as it appears, into a great number of branches, which diverging to the east and west form a delta, which probably occupies as large an area as that of the Nile, though it would be rather premature to decide this point, as the extent of the delta of the Quorra has not yet been ascertained. It differs greatly from that of the Nile, its surface being mostly covered with swamps, and in other places with jungle. Some parts of it are covered with high forests. The more elevated tracts of the delta are cultivated, and villages occur at distances of two or three miles, but most of them are surrounded by jungle, and not visible from the river. The river is frequently more than two miles wide, but in several places it contracts to a mile and even less, especially towards its mouth. The tide is perceptible to about 100 miles from its mouth.

The whole course of the river probably exceeds 2000 miles. We do not know that any of its tributaries are of considerable size, except the Sharry or Tchadda, which joins it near 8° N. lat., and is not inferior in size to the principal river, though less deep. It has been ascended about 100 miles, but is full of rocks and sand-banks. The volume of water brought down by this river evidently shows that it must have a long course, and this, with some other facts, has induced Captain Allen to suppose that the Tchadda is the only channel by which the lake Tchad, situated in the interior of Súdan, between 12° and 15° N. lat. and 12° and 17° E. long., discharges its waters into the Quorra.

In the year 1832, Mr. Macgregor Laird, and some other gentlemen of Liverpool, formed an association for the purpose of opening a direct communication with the interior of Africa by ascending the Quorra. Two steam-boats were fitted out for the expedition, and a sailing vessel was also equipped to carry out the goods with which it was proposed to trade with the natives. The crew of the larger steam-vessel, the Quorra, including the officers, consisted of twenty-six men; and that of the Alburkah, the smaller steam-vessel, consisted of fourteen men. Richard Lander, already known by his African journeys, was engaged to take the direction of the expedition, and he had also the selection of the goods with which it was supposed that a valuable trade in indigo and other produce could be carried on. The expedition was also joined by Captain (then Lieutenant) Allen, for whom the Admiralty had requested a passage for the purpose of making a survey of the river. The expedition reached the mouth of the Quorra in safety, and the river was ascended to Rabba in 9° N. lat.; the Tchadda was also ascended to Dagbeh, in 8° N. lat., a distance of above 100 miles from its confluence with the Quorra. The results of the expedition were most disastrous. It was indeed shown that the Quorra is navigable in moderate-sized vessels from the sea to Boussa; but as a commercial speculation the expedition entirely failed, and it was attended with a melancholy loss of life caused by the climate. The only survivors of the Alburkah were Mr. Oldfield, the surgeon, and three others: the survivors of the Quorra were Lieut. Allen, Mr. Macgregor Laird, and three others. Hill, the captain of the Alburkah, and Harries, the captain of the Quorra, were among the victims. Dr. Thomas Briggs, the physician to the Quorra, also died. He was the eldest son of Dr. Briggs of Liverpool. Though only twenty-eight years old at the time of his death, his acquirements were such as to give promise of the highest excellence. His clear and penetrating understanding enabled him to master any subject to which he applied; and his virtues secured the respect and love of all who knew him.

On the 26th of December, 1839, the Colonial Secretary, Lord John Russell, addressed a letter to the Lords of the Treasury, in which he stated that the average number of slaves introduced from Africa into foreign states or colonies in America or the West Indies probably exceeds 100,000 annually, and that the most likely means of effectually abolishing the foreign slave-trade would be to arrest it at its source by the establishment of new commercial relations with those African chiefs or powers within whose dominions the internal slave-trade of Africa is carried on, and the external slave-trade supplied with its victims. Of those chiefs the most considerable rule over the countries adjacent to the Niger and its tributary streams. It was therefore proposed by her Majesty's ministers to dispatch an expedition which would ascend that river by steam-boats; and they requested the sanction of the Lords of the Treasury for the estimated amount of expense which would be required for the fitting-out and maintenance of the expedition; to which the assent of the Lords of the Treasury was given on the 30th December, 1839.

A good deal of opposition has been made to this expedition by some of the merchants of Liverpool who are engaged in trading up the Niger, and one of them, Mr. Jamieson, has published 'Grounds of Appeal against the Niger Expedition,' in which he contends that the slave-trade 'has almost entirely ceased on that part of the African coast, that private enterprise is rapidly extending our commerce up the Niger, and that the interference of government will immediately put a stop to that commerce, 'since no private merchant can keep his ground in or near a government merchant-settlement bolstered and sustained by the public purse.'

Government however has resolved to persevere in making commercial treaties, in opening the way for all private traders, and in examining the geography of that part of central Africa. We are indebted to Captain Washington, R.N., for the following communication respecting the expedition, which will probably have sailed before the end of this year (1840). It is composed of three iron steam-vessels, of small draft of water, fitted for river navigation. After touching at the ports of Sierra Leone, Cape Coast Castle, &c., they will proceed up one of the many outlets of the Quorra, for about 300 miles, to the confluence of the Tchadda. This will probably be made their head-quarters, and the commissioners will use their utmost endeavours to form treaties for lawful traffic and for the extinction of slavery with all the native chiefs. Should opportunity be afforded, the vessels will explore the upper part of the Quorra, towards Rabba and Boussa, and also the Tchadda, as far as water-communication will admit of it; thus pioneering the way and opening the high road to the lawful merchant, to the man of science, and the missionary.

(Park's *Travels in Africa*; Mollien's *Travels in Africa, &c.*; Laing's *Travels in the Timantee, &c.*; Caillié's *Travels through Central Africa*: Clapperton's *Journal*: Lander's *Journal*; Allen, 'On a new construction of a Map of a portion of Western Africa,' &c., in *London Geogr. Journ.*, vol. viii.; and Laird and Oldfield's *Narrative of an Expedition into the Interior of Africa, &c.*)

QUORUM. [SESSIONS.]

QUOTIENT, or **QUOTE,** the result of dividing one number by another

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R.

R is one of the vibrating letters called liquids. It is formed at the back of the palate, and is on this account more nearly related to the liquid *l* than to *n* or *m*. For the various forms of the alphabetical symbol see ALPHABET. It is convertible

1, with *l*. See that letter.
2, with *n*. See that letter.
3, with *rn* at the end of words. See N.
4, with *s*. See S.

5. It is apt to place itself at one time before, at another after a vowel. Thus in Greek *κροκοδειλος* or *κορκοδειλος*, *κρατος* or *καρτος*. So the English words *red*, *run*, are changed the Dorsetshire dialect to *hird*, *hirn*. Again, *brid* is an old orthography of *bird*, and the town *Bridlington* is pronounced *Burlington*.

6. The letter *r*, in the neighbourhood of several consonants, is apt to disappear from words. Thus the German *sprech-en* is in English *speak*, our word *world* is in German *welt*.

7. In one language a word is found with an initial *r*, when in other allied languages there occur at the beginning two consonants, as *br*, *fr*, *wr*. Thus in Greek we have *ροδον*, *ρηγνυμι*, *ρεζω*, connected with which are the forms *βροδον*, *frango*, Latin, and *break*, English; and, thirdly, the English words *wreak*, *work*, *wrought*.

8. The letter *r* is at times confounded with *w*. Thus it is not a very rare variety of articulation that *rubbish* is pronounced *wubbish*.

9. More particularly when a word ends in a *w*, or even a vowel, it is not uncommon to pronounce an *r*, especially if the next word begins with a vowel. The London vulgarism, *winder*, *piller*, for *window*, *pillow*, is an example, nor need the philologist be ashamed to treat of such cases, which are as worthy of consideration as any dialect of the Greek tongue.

RAAB (in Hungarian, Györ, or Nagy Györ) is the capital of the county of the same name in the circle beyond the Danube. It is situated in 47° 41′ N. lat. and 11° 6′ E. long., in an extensive marshy plain, where the rivers Raab and Rabnieza fall into the Danube, and it is nearly surrounded by those three rivers. At a distance the steeples of its numerous churches give it a striking appearance. The streets are pretty regular and well-paved, and there are many handsome houses. Raab is divided into what is called the inner town or fortress, which has three gates, and the extensive suburbs. There are eight Roman Catholic churches, of which the most remarkable are the church of the Benedictines, formerly belonging to the Jesuits, and the cathedral, with a splendid choir and marble altars. There are also a Lutheran and a Greek church, a convent of Carmelite monks, and another of Ursuline nuns. Of the secular buildings, the chief are the bishop's palace, the county-hall, the town-hall, the royal academy, the episcopal seminary, the salt-office, the palaces of Count Esterhazy and Count Zichy; besides the seminary, and the academy, which has two faculties, jurisprudence and philosophy, ten professors and between 300 and 400 students, there are a gymnasium, a theological college, a lyceum, a Lutheran gymnasium, and several schools. There are likewise an indifferent theatre, assembly-rooms, an arsenal, two barracks, and two large poorhouses. Raab is the see of a Roman Catholic bishop and chapter, and the seat of government of the county.

Raab was a place of strength in the time of the Romans. Subsequently a people, whose name is not known, settled on the spot where the Romans had their winter-quarters. Their numbers having considerably increased, [illegible]ey were invited, in 1271, by king Stephen V., to live in the fortress of Raab, which he had erected, promising them considerable privileges. In 1593 the fortress fell into the hands of the Turks, through the treachery of the governor. It was retaken by the Austrians in 1598, on Easter Monday, on which day this event is commemorated with great pomp. In the year 1783, the emperor Joseph II. ordered the fortress to be totally dismantled, but in 1809 the emperor Francis ordered it to be again fortified. On the 14th of June in that year the French, having defeated the Hungarians, under the archduke John, near the town, laid siege to it, and became masters of it on the 24th, by capitulation. In 1820 orders were given again to level the fortifications, in doing which many gold, silver, and brass coins of Vespasian were found. Raab has nearly 18,000 inhabitants, of whom 5000 live in the inner town. The site of the old ramparts has been partly converted into public walks and partly used for new and handsome streets. The manufactures of woollen cloth, cutlery, and vinegar are considerable. The culture of silk is every year extending. Three much frequented annual fairs are held, and the town carries on a very brisk trade, which is much favoured by its situation on the navigable Danube, and on the high road between Vienna and Ofen.

(*Beschreibung des Königreichs Ungarn, &c.*, 1833; *Oesterreichische National Encyclopedie*; J. C. v. Thiele, *Das Königreich Ungarn*.)

RABATT. [MAROCCO.]

RABBI (*ῥαββί*, רַבִּי), a title of respect, similar in meaning to our word master or teacher, which was given to the teachers of the Jewish law by their disciples and the people in the time of Christ. (*Matt.*, xxiii. 7.) The title was often given to Christ by his disciples. (*Matt.*, xxvi. 25, 49; *Mark*, ix. 5; xi. 21; *John*, i. 38; iv. 31.) It is doubtful when it was first introduced. It is admitted by Jewish writers that it was not in use before the time of Hillel of Babylon, who lived in the first century before the Christian æra; and it was perhaps first introduced into the Jewish schools about the time of Christ. The word was originally used in three forms: *Rab* (רַב), as the lowest degree of honour; *Rabbi* (רַבִּי), of higher dignity; and *Rabban* (רַבָּן), or *Rabboni* (*ῥαββονί*), which was the most honourable of all. The title of rabboni is given to Christ on two occasions in the evangelists. (*Mark*, x. 51; *John*, xx. 16.)

The title of rabbi has continued in use among the Jews in modern times. The term rabbinical has been given to all the Jewish writings composed after the Christian æra. Some account of the most important of these works is given under HEBREW LANGUAGE, p. 92.

(Buxtorf, *Lexic. Chald. Rab. Talmud.*, 2176; Lightfoot, *Hor. Hebr. ad Math.*, xxiii. 7; Hill, *De Hebraeor. Rabbinis*, Jen., 1741; Winer, *Biblisches Realwörterbuch*, art. 'Rabbi.')

RABBIT. [LEPORIDÆ.]

RABDOLOGY. [NAPIER'S BONES.]

RABELAIS, FRANÇOIS, born in 1483, at Chinon in Touraine, of humble parents, entered the order of St. Francis, but his jovial temper and satirical humour made him obnoxious to his brother monks, and he was glad to obtain permission to remove into a convent of Benedictines. But here also he could not sympathise with the habits of his brethren, and at last he ran away from his convent, and went to Montpelier, where he studied medicine and took his doctor's degree. He practised as a physician, though he retained the garb of a secular priest· in his capacity of physician he became known at the court of Francis I. In 1536 he accompanied Cardinal du Belloi to Rome, and obtained the pope's absolution for the breach of his monastic vows. On his return to France he obtained a prebend in a collegiate church, and was afterwards appointed curé or rector of Meudon, in which situation he continued till his death in 1553.

Rabelais was a man of extensive and varied information; he was acquainted with the principal European languages, besides Latin and Greek, but his principal merit consists in the acuteness with which he caught at and exposed the absurdities and the vices of his contemporaries, sheltered as they were by hallowed prejudice or by the cloak of superstition and hypocrisy. His principal work is a satirical novel, in which, under an allegorical veil, he lashes all classes of society, kings, statesmen, scholars, clerical as well as lay, prelates and popes, and especially monks, of whom he seems to have had a special dislike. Rabelais took for his first hero Gargantua, a gigantic personage, about whom there were many wonderful traditional stories, to which

Rabelais added many more. Gargantua lived for several centuries, and at last begot a son, Pantagruel, who is as wonderful as himself; beneath his tongue a whole army takes shelter from rain; in his mouth and throat are cities which contain an immense population, &c. The adventures of these personages are all ridiculous, and are described in humorous language, which often descends to low buffoonery and frequently to obscenity, according to the taste of the age. But under this coarse covering there lies a moral, for Rabelais meant to correct and improve society by his satire. He exposes the faults of the education of his time, the barbarous eloquence of college pedants, the folly of scholastic disputation, and the pretensions of self-styled philosophers; all which are successively held up to ridicule in the harangue of Janotus de Braginardo, in which he demands back the bells of the cathedral of Notre Dame, which Gargantua had detached from the belfry and appended to the neck of his mare; in the curious catalogue of the books of the library of St. Victor; in the disputation carried on by signs between Panurge and the English Thaumaste; and, lastly, in the description of the prodigies which science had produced in the country of Quint-Essence, or kingdom of Entéléchie. In another part of his work the author exposes the manners of courts and the weakness even of good monarchs. Pantagruel is a virtuous prince, devout, and severe in his morals, and yet he takes for his favourite Panurge, an arrant rogue, a drunkard, a coward, and a libertine, who seems to be a counterpart of the Margutte of Pulci's 'Morgante Maggiore,' for Rabelais was acquainted with the Italian romance writers, whose tales of giants and heroes and their wonderful achievements he probably had in view in his caricatures. The disastrous wars of Charles VIII. and Francis I. had produced too many evils in his time not to attract Rabelais' censure. To the headlong ambition of those conquerors he opposes the prudence and moderation of his heroes, who, before they enter upon even a defensive war, exhaust every means of conciliation. Two of the rash provokers of the conflict are overthrown: one is dethroned, and nobody knows what becomes of him; the other is transformed into a crier of mustard, and the circumstances which lead him to this change of condition are no less boldly imagined and described than the metamorphosis itself.

Rabelais sneers openly at the pretensions of the popes to interfere in temporal matters, and in his fourth book he exposes the pretended mortifications of a certain class of devotees who feasted on meagre days on a variety of dishes of the finest fish and other savoury things: 'Comment ès jours maigres entrelardés à leur dieu sacrifioient les gastrolatres.'

It has been assumed by some that Rabelais' work is a continued allegory of the events and personages of his time; and people have fancied that they recognised Francis I. in Gargantua, Henri II. in Pantagruel, Louis XII. in Grand Gousier, &c. This however seems very doubtful, and the notion has been strongly combated by Ch. Nodier, in an article, 'De quelques livres satiriques et de leur clef,' Paris, 1834. It seems more likely that Rabelais made occasional allusions to some of the leading characters of his age and their prevailing faults, while he lashed in general the vices and follies of society. With regard to the traditional stories of Gargantua, which he took for his subject, see 'Notice de deux anciens Romans, intitulés les Chroniques de Gargantua, où l'on examine les rapports qui existent entre ces deux ouvrages et le Gargantua de Rabelais, et si la première de ces Chroniques n'est pas aussi de l'auteur de Pantagruel,' by J. Ch. Brunet, author of the 'Nouvelles Recherches Bibliographiques,' Paris, 1824.

The romance of Rabelais has gone through several editions, and has been translated into German and English. One of the best French editions is that by Duchat, 'Œuvres de Maître François Rabelais, avec des remarques historiques et critiques,' 3 vols. 4to., Amsterdam, 1741. It is accompanied by notes explanatory of the old French words used by Rabelais, which are now obsolete. It also contains Rabelais' letters from Italy, which were published separately by M. de Sainte Marthe, Bruxelles, 1710, with curious historical remarks by the editor. A new and improved French edition of the works of Rabelais was lately published by E. Johanneau and Esmangart, with a biography of the author, and his 'Songes drolatiques,' being a collection of one hundred and twenty caricatures, designed by Rabelais himself, and intended to represent the characters of his romance, and also his 'Sciomachie,' a work which had become extremely scarce. Swift, in his 'Gulliver's Travels,' has imitated Rabelais. Rabelais was charged in his lifetime with irreligion and heresy, but he was protected by Francis I., who, having read his romance, said that he found no grounds for the charge. In the conversation between Grippeminaud and Friar John, Rabelais expresses in a striking manner the terror produced in those times by an accusation of heresy. Rabelais knew Calvin, who at one time thought of numbering him among his followers, but there was too much dissimilarity between the two men to allow any such connection, and Calvin having gravely censured Rabelais for his profane jesting, the satirist took his revenge by placing in the mouth of Panurge, while buying a sheep of Dindenault, some of the theological expressions of his austere monitor.

RABENER, GOTTLIEB WILHELM, born in 1714, at Wachau near Leipzig, was educated in the public school at Meissen. In 1734 he went to the university of Leipzig to study the law, where he became acquainted with some of the most eminent men of the age, and formed an intimate friendship with Gellert, with whom he took an active part in the establishment of a celebrated literary periodical called 'Bremer Beiträge.' In 1741 he received an office in the board of taxes for the circle of Dresden, and in 1763 he was appointed counsellor of the court of aids (Steuerrath), which office he held until his death, on the 26th of March, 1771.

Rabener was, in his time, one of the most popular writers in Germany, and he exercised a very beneficial influence upon his countrymen. His satires, in which he attacked the most glaring follies, fashions, and pretensions of his time, though not marked by much depth of thought, are still instructive and amusing as historical pictures of the age in which he lived, for the things which he ridiculed have long ceased to exist. His attacks were not directed against vice, but against follies and absurdities, especially those of the middle classes; his satires therefore are not characterised by indignation or bitterness, but by a good-natured and amiable humour, his object being to improve his countrymen by ridiculing some of their absurd habits. His satires show great power of observation and a cheerful disposition combined with a considerable share of wit; the style is easy and attractive, though sometimes rather prolix. With the exception of one, they are written in prose, and were first published in several periodicals. The first collection of them appeared in 1751, at Leipzig, in 2 vols.; the year after, another, and in 1755, a fourth volume was added. A complete edition, with a Life of the author, was published in 1777, in 6 vols.

RACAMI'NÆ. [VULTURIDÆ.]

RACCOON. [URSIDÆ.]

RACE. [MAN.]

RACE HORSE. [HORSE.]

RACE'MIC ACID—*Paratartaric Acid.* The composition of this acid is similar to that of tartaric acid [TARTARIC ACID]; they are consequently isomeric bodies: they are associated in the grape of the Upper Rhine, the racemic acid probably existing as a biracemate of potash, which, during the process of fermentation, subsides with the bitartrate of potash.

Racemic acid is prepared by saturating the tartar of the above-named district with carbonate of soda, separating the tartarate of potash and soda, which crystallizes, from the racemate, which does not; to the residual solution a salt of lead or lime is added, and, the precipitate formed being decomposed by dilute sulphuric acid, a solution of racemic acid is obtained, which by evaporation yields crystals.

The crystal of racemic acid, like that of the tartaric, is an oblique rhombic prism, and their saturating power, as well as their composition, are similar; there is also a close analogy in their general chemical relations: each forms insoluble salts with the same bases, as with lime, barytes, and oxide of lead. Biracemate, like the bitartrate of potash, is also a salt of sparing solubility; with oxide of antimony biracemate of potash forms a salt analogous to the emetic tartar which the same oxide yields with bitartrate of potash; their crystalline form is however different. The chief differences between these acids are—the less solubility of the racemic; its containing in its crystallized state two equivalents instead of one of water, one of which it loses at 212°, and the other by combining with alkalis; it does not, like tartaric acid, form a double salt with potash and soda, and the racemate is a less soluble salt than the tartrate of lime.

Racemic acid is composed of

Two equivalents of hydrogen .	2
Four equivalents of carbon .	24
Five equivalents of oxygen .	40
Equivalent .	66

The crystals are composed of

One equivalent of anhydrous acid	66
Two equivalents of water . .	18
Equivalent .	84

RACHITIS. [Rickets.]

RACINE, JEAN, born towards the end of 1639, at Ferté Milon, was the son of an officer of the Excise. He lost both his parents while he was a child. He studied first at Beauvais, and afterwards in the celebrated school of Port Royal des Champs, under Lemaistre, Lancelot, and the Abbé Hanon. He applied himself especially to the study of the Greek poets. After three years spent at Port Royal, he went to finish his education at Paris, in the Collège d'Harcourt, in 1658. He had long shown a decided inclination for poetry; and on the occasion of the marriage of Louis XIV., in 1660, he entered the lists with various other poets who wrote in honour of that event; and his composition, 'La Nymphe de la Seine,' was considered as the best of the whole. It was noticed by the king, who sent to the young poet, through Colbert, a present of 100 louis-d'or. In 1664 Racine brought out his first tragedy, 'La Thebaïde, ou les Frères Ennemis,' a subject which was suggested to him by Molière. He next wrote his 'Alexandre,' which is a feeble composition. Corneille, who was then grown old, advised Racine to give up writing tragedy. Boileau, on the contrary, encouraged him; and Racine, having studied hard for some years to improve himself, produced, in 1667, his 'Andromaque,' which was acted with great applause. In the next year he wrote 'Les Plaideurs,' a humorous comedy in imitation of the 'Wasps' of Aristophanes, which was so much relished by Louis XIV., that he bestowed upon the author a pension, accompanied by a very flattering letter. Racine now produced in succession 'Britannicus,' 'Bérénice,' 'Bajazet,' 'Mithridate,' 'Iphigénie,' and 'Phèdre,' which last is often considered his master-piece. But when 'Phèdre' was first brought on the stage, in 1677, a rival coterie intrigued against him, and succeeded in running down the work, which so disgusted Racine, that he resolved to write no more plays. About that time he married the daughter of the treasurer of Amiens, a match which proved a happy one. Racine frequented the court, where he had a warm friend in Madame de Maintenon, and he was appointed by Louis XIV. historiographer of the kingdom, together with Boileau. Of his historical labours however only a few fragments remain. Several years after, at the entreaty of Madame de Maintenon, he wrote another drama, 'Esther,' which was acted in the house of education of St. Cyr, in 1689, and was well received. In the following year he wrote 'Athalie,' which was performed in the same place, and was afterwards published, but it was received very coldly, although it has since been acknowledged to be Racine's noblest composition. This was also Boileau's opinion at the time, who told him so, adding, that the judgment of the public would right itself in time, a prediction however which was not accomplished till long after Racine's death.

'Athalie' was the last play of Racine. He continued to visit Madame de Maintenon, to whom he used to read parts of his projected history of Louis XIV. As he came to advert to the system of administration, he could not help reflecting upon the wanton prodigality of expenditure, the enormous burthen of taxation, the disastrous wars caused by mere ambition, and the consequent distress of the country and the misery of a great part of the population. Racine was a man of honest feelings: he became animated with his subject; and Madame de Maintenon was evidently affected by his picture. She suggested to him to draw up a memoir of what he thought could be done in the way of alleviating the distress of the people. Racine complied, and delivered his memoir to Madame for her perusal. As she was reading it one day in her cabinet, Louis XIV. entered, and she could not conceal from him the paper nor the author of it. Louis, having glanced at the memoir, observed with a frown, that 'as M. Racine could make excellent verses, he fancied that he knew everything; as if, because he was a great poet, he ought to be also a minister of state. Racine was informed of this, and from that time he was banished from the court. He had been for some years in a declining state of health, under the influence of mental excitement and of melancholy; and the mortification which he now felt, embittered his sufferings. His complaint, which was an abscess in the liver, was badly treated by the physicians, and he sank rapidly. Louis XIV., being informed of his danger, showed great interest in his fate, and sent to inquire after him: indeed the whole court sympathised with the dying poet. At last an operation was performed; but three days after, Racine expired, in the midst of acute pain, on the 21st April, 1697, in his 59th year. He was interred, according to his request, in the abbey of Port Royal des Champs, a spot for which he had always retained a great affection. After the destruction of that monastery, in 1709, the remains of Racine were transferred to Paris, and deposited in the church of St. Etienne du Mont, by the side of those of Pascal. Louis XIV. bestowed upon his widow a pension of 2000 livres, and the reversion of it on her sons till the death of the youngest.

The plays of Racine have gone through many editions; one of the best is that of 1768, 'Œuvres de Jean Racine, avec des Commentaires par Luneau de Boisjermain,' 6 vols. 8vo. It also contains his 'History of Port Royal,' the 'Fragmens Historiques,' several discourses delivered in the French Academy, of which he was a member, and other small compositions, with a biography of Racine.

His son Louis Racine published memoirs of his father's life, two volumes of commentaries on his plays, and a poem, 'La Religion,' in six cantos.

The peculiar merits and deficiencies of Racine's plays are noticed under 'French Drama,' in the article English Drama. He adhered strictly to what are called the classical unities, and his subjects were chiefly taken from antient history; but his personages, though Greek or Roman by name, are French in their character. His great merit lay in his delineation of the passions, his exquisite pathos, and the harmony of his verse.

RACK. [Arrack.]

RACK. [Torture.]

RADACK and RALICK, are two chains or groups of coral islands, situated in the Pacific between 5° 30′ and 12° N. lat., and between 167° and 173° E. long. The chains extend nearly due north and south, and are not much more than 100 miles from one another. Radack, which is the eastern, consists of twelve groups of small islands, enclosed and connected with one another by coral reefs rising several feet above the sea-level. The sea which separates the single groups is of great depth. The chain of the Ralick islands is less known, and is said to consist of nine groups and three single islands. The islands themselves are of small extent, and in general situated on the windward or eastern side of the lagoons formed by the extensive coral reefs; most of them are on the reefs themselves. They are low, but well wooded. The bread-fruit tree and the pandanus are most numerous; there are also a few cocoa-nut trees. The inhabitants seem to belong to the Malay race, but they differ entirely in language, so far as is known, from the inhabitants of the other islands of the Pacific. They seem to be distinguished by great good-nature and simplicity. They have made some progress in civilization, as they mostly live on the produce of their orchards, and have commodiously built houses. Their larger boats are more than 30 feet long, and the sails are made of finely braided mats, and managed with considerable art. Though some islands belonging to this group may have been seen before, they were discovered in 1816, by Otto von Kotzebue, and some of them were more closely examined.

(Kotzebue's *First Voyage of Discovery into the South Sea and Behring's Straits.*)

RADCLIFFE, JOHN, M.D., was born of an 'antient and respectable family' (Ingram's *Memorials of Oxford*, No. 28), at Wakefield in Yorkshire, in the year 1650, and having acquired a competent knowledge of the learned languages at the grammar-school of his native town, was admitted a member of University College, Oxford, at the age of fifteen. He took his degree of B.A. in 1691, and became senior scholar of his college, but, as no fellowship became vacant there, he removed to Lincoln College, of which he had been previously invited to become a fellow. He took his degree of M.A. 1672, and commenced the study of physic, which he pursued in no other medical school, but attended the different courses of anatomy, chemistry, and botany delivered in the University. He is represented by his biographers as having 'recommended himself more by ready wit and vivacity than by any extraordinary acquisitions in learning,' and his books were so few in number, that, being visited in his rooms by Dr. Bathurst, the president of Trinity College, and asked by him where was his library, he pointed to a few vials, a skeleton, and an herbal in one corner of his room, and exclaimed with emphasis, 'There, sir, is Radcliffe's library.' In 1675 he took his degree of M.B., and began to practice as a licentiate in Oxford, where by some happy cures he soon acquired a great reputation. In 1677 he relinquished his fellowship in accordance with the statutes of his college, which require all the fellows after a certain time to enter into holy orders. He wished however to keep his rooms in college, and to reside there as a commoner, but this Dr. Marshall, the Rector (who is supposed to have been offended at some witticisms pointed at him by Radcliffe), refused to allow, which so much disgusted him that in after-life he lavished the whole of his munificence on his former college, University, leaving to Lincoln only the second presentation to a living if no fellow of University chose to accept it.* In 1682 he took the degree of M.D., and went out a Grand Compounder; an important ceremony in those times, and for a century afterwards, being accompanied with much expensive pomp and solemnity; all the members of the college walking in procession with the candidate, himself bare-headed, to the Convocation House. At length, in 1684, he removed to the metropolis, and settled in Bow Street, Covent Garden, where in less than a year he got into great practice, to which perhaps his pleasantry and ready wit contributed as much as his reputed skill in his profession. He was now in the high road to wealth and reputation, but it would be tedious and useless to trace all the steps of a man destitute of all the ornaments of a liberal profession, and who, as Richardson relates, once said to Dr. Mead, 'I love you, and now I will tell you a sure secret to make your fortune; *use all mankind ill:*'—by which he meant, to regard his interests and his humour as superior to all considerations of duty or propriety. There is reason however to suppose that he aimed at a vigorous and decisive method of practice, which distinguished him from the inert practitioners of the day; and it is no small praise to have obtained Dr. Mead's testimony, that 'he was deservedly at the head of his profession, on account of his great medical penetration and experience.'

In 1686 he was appointed by the princess Anne her principal physician, and from this time till his death he enjoyed the undisputed favour of the court, during the reigns of William and Anne; and although he often offended both the king and queen by his freedoms, yet such was the opinion of his medical skill, that he was always sent for in any case of danger. There are few events in his life that require particular notice, and the greater part of his biographers have only given a collection of anecdotes showing at once his wonderful skill in forming a correct prognosis, his rudeness and brutality towards his patients even of the highest rank, and the enormous sums of money which he received as fees. The reader will find abundance of these anecdotes in 'The Gold-Headed Cane;' 'The Georgian Era;' 'Lives of British Physicians,' in the *Family Library;* Ingram's 'Memorials of Oxford,' &c. Towards the end of the reign of James, the then celebrated Master of University College, Obadiah Walker, his fellow-collegian, was in vain employed to influence his religious principles. The answer of Radcliffe was firm and dignified: that 'being bred up a Protestant at Wakefield, and having continued such at Oxford, where he had no relish for absurdities, he saw no reason to change his principles and turn Papist in London.' In 1693 he entered upon a treaty of marriage with the only daughter of a wealthy citizen, and was near bringing the affair to a conclusion, when it was discovered that the young lady had an intrigue with her father's bookkeeper, which disappointment had such an effect upon him, that he determined to continue in celibacy. In 1713 he was elected into parliament for the town of Buckingham, but only two of his speeches have been preserved, and it does not appear that he was at all distinguished as a senator. He was sent for to attend Queen Anne when she lay at the point of death, but, being much indisposed himself, and knowing the case to be desperate, he declined coming, for which he was much blamed at the time, and intimation was given him that the populace in London were disposed to tear him in pieces if he should venture to come to town from his country-house. It is probable that the agitation of his mind concurred with a broken constitution in bringing him to an end two months afterwards, November 1, 1714, at the age of sixty-four. His body lay in state at the house at Carshalton, where he died, till November 27; it was then removed to an undertaker's in the Strand, and thence escorted to his favourite city Oxford, where it was interred with great solemnity in St. Mary's church, near the north-west corner of the present organ-gallery, with the following simple inscription engraven on a brass plate on his coffin: 'John Radcliffe, Dr. in Physick, dyed Nov. y^{e} 1st., 1714, in the 65th year of his age.'

In Radcliffe's character there really seems to be very little to admire. His refusing to embrace Romanism gives him but a slight claim to be considered a pious man, when all the rest of his conduct showed his carelessness and indifference to religion. He indulged in the pleasures of the table to excess, and is supposed to have shortened his days by his intemperance. There are upon record a few noble instances of his liberality during his lifetime, but not so many as might have been expected from his immense wealth. Richardson says 'he owned he was avaricious, even to spunging, whenever he anyway could, at a tavern reckoning, a sixpence or shilling, among the rest of the company, under pretence of "hating (as he ever did) to change a guinea, because (said he) it slips away so fast."' He could never be brought to pay bills without much following and importunity; nor then, if there appeared any chance of wearying them out.'

It only remains to give some account of his posthumous benefactions, which were indeed most munificent, and which well entitle him to hold a place in the long list of benefactors to the University of Oxford. After making a life provision for some of his relations, he bequeathed his whole fortune to public uses. To St. Bartholomew's Hospital in London he gave for ever the yearly sum of 500*l.* towards mending their diet, and the further yearly sum of 100*l.* for buying of linen. He left 40,000*l.* for the building of a library at Oxford, which he endowed with an annual stipend of 150*l.* for the librarian (who is chosen by the same electors that appoint the travelling fellows, to be hereafter mentioned); 100*l.* per annum for repairs, and 100*l.* per annum for the purchase of books. A description of this building is given under OXFORD [vol. xvii., p. 99]. It was at first called 'The Physic Library,' being intended chiefly for books and manuscripts relating to the science of physic; comprehending, as that term was then understood, anatomy, botany, surgery, and natural philosophy. Accordingly, in compliance with a resolution of the trustees, the purchase of books is still entirely confined to works connected with natural history and medicine, and it may be added that the very small sum destined by Radcliffe for the buying of books is often exceeded. The foundation stone was laid with great ceremony, May 17, 1737; and, being completed in about ten years, it was at length opened in a most solemn manner, on Thursday, April 13, 1749; when the Duke of Beaufort, in behalf of himself and the other trustees, formally delivered the key to the vice-chancellor 'for the use of the University.' The first librarian was the Rev. Francis Wise, B.D. of Trinity College: the present one is John Kidd, M.D. of Christ Church, Regius Professor of Medicine. To University College he left 5000*l.* to build the master's lodge there, making one side of the eastern quadrangle. He also left them his Yorkshire estate in trust for the foundation of two Travelling Fellowships to be held by 'two persons to be chosen out of the University of Oxford, when they are M.A., and entered on the Physic line.' The electors are, the Archbishop of Canterbury, the Lord Chancellor, the Chancellor of the University, the bishops of London and Winchester, the two principal secretaries of state, the two chief justices of the Queen's Bench and Common Pleas, and the Master of the Rolls. The appointment is 300*l.* per annum to each of the fellows, and apartments in University College. They hold their fellowships 'for the space of ten years, and no longer, the [first] half of which time, at least, they are to travel in parts beyond sea for their better improvement.'* He also bequeathed the perpetual advowson of the rectory of Headbourne Worthy, in Hampshire, to trustees for the benefit of University College for ever, so that a member of that society should always be presented to it on every vacancy. He gave to the same college during his life 1100*l.* for increasing their exhibitions and for general repairs, and the painted window at the east end of their chapel appears to be his gift by the following inscription under it: 'D.D. Joan. Radcliffe, M.D., hujus Collegii quondam Socius, A.D. MDCLXXXVII.' After the payment of the bequests above mentioned, he gave to his executors, in trust, all his estates in Buckinghamshire, Yorkshire, Northamptonshire, and Surrey, to be applied in such charitable purposes as they all, in their discretion, should think best: but no part thereof to their own use or benefit. The first trustees were the Rt. Hon. William Bromley, principal secretary of state, Sir George Beaumont, Bart., Thomas Sclater, of Gray's Inn, Esq., and Anthony Keck, of Fleet Street, Gentleman. The present trustees are Lord Sidmouth, Sir Robert Peel, W. H. Ashurst, Esq., W. R. Cartwright, Esq., and T. G. Bucknall Estcourt, Esq. Out of these funds were built the Infirmary (1770) and the Observatory (1772) at Oxford, and the Lunatic Asylum on Heddington Hill near that city also received so much assistance from the same source (1827), that the committee gave it the name of the 'Radcliffe Asylum.' In 1825 the trustees gave 2000*l.* towards building the present College of Physicians in London, and they have ever been found ready to contribute according to their means to every charitable and useful purpose.

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* A different account is given in the Life of Kettlewell, prefixed to his works, from which it appears that Radcliffe was offended because a friend of his own, of University College, was not chosen to fill up his place at Lincoln.

* They are at present required to 'pass the *first* five years beyond sea, because in the last century it happened in two different instances that the Travellin

RADCLIFFE LIBRARY. [OXFORD.]

RADEMACKER, GERARD, was born at Amsterdam, in 1673. His father, an architect, much esteemed by Lairesse and other artists, instructed him in the first principles of drawing and perspective, and would have brought him up to his own profession, but perceiving his predilection for painting, he placed him under A. Van Goor, a respectable portrait-painter. Gerard applied himself to his studies with unremitting perseverance so long as his master lived, and at his death, being sufficiently advanced to give lessons in design, he was engaged by the bishop of Sebaste to teach his niece drawing. His agreeable manner gained the favour of the bishop, who, being soon afterwards obliged to go to Rome, invited Rademacker to accompany him; he spent three years at Rome, and greatly improved himself by indefatigable study. He was fond of representing views of the principal ruins and antient monuments, which he designed with great accuracy and spirit. On his return to Holland, his extraordinary success produced him numerous friends and abundance of employment. He did not however confine himself to architectural subjects, but painted many historical and emblematical pieces. His fertile invention and facility of execution enabled him to paint many pictures in a short time. He is reckoned one of the best masters of the Dutch school for the grandeur of his style, which had been cultivated by the study of the best models. He died at Amsterdam, in 1711.

RADEMACKER, ABRAHAM, supposed to be a younger brother of Gerard, was born at Amsterdam, 1675, and attained a high rank as a landscape painter without the assistance of a master. At first he drew in Indian ink, in which style he acquired great perfection; his early productions are in water-colours, and very highly finished; and he subsequently painted with equal success in oil-colour. His invention was extremely fertile; he composed readily and agreeably, and embellished his landscapes with picturesque ruins and buildings, and adorned them with well-designed groups of figures and animals. He engraved a set of nearly 300 plates, from his own designs, of the most interesting views of antient monuments in Holland and the Austrian Netherlands. They are executed in a masterly manner, and were published at Amsterdam in 1731. He died in 1735.

RADIATION OF HEAT is a motion of its particles in rectilinear directions, diverging every way from a heated body, either luminous or not; and it is imagined to arise from the existence of a strongly repulsive power by which the particles are made to recede from each other with great velocity. The intensity of heat thus emitted from a point of radiation is obviously the same at equal distances from the point; and, at unequal distances, it is inversely proportional to the squares of the distances. The radiating particles falling upon the surfaces of any bodies in the vicinity of that from which they emanate, are, according to the nature of those bodies, absorbed in them, or transmitted through them, or again they may be reflected from them; and, in the two last cases, the radiant heat, as it is called, appears to suffer modifications analogous to those which, in like circumstances, take place in light. According to M. Prevost (*Essai sur la Calorique Rayonnante*, 1809), the radiation of heat is a process which is perpetually going on among all the bodies in nature; those which are of equal temperature mutually interchanging equal quantities of caloric; but, with respect to two bodies which are unequally heated, that which has the greatest quantity sends forth emanations in greater abundance than the other; the difference however diminishing as both bodies approach to an equality of temperature.

The particles of heat (calorific particles) appear to move with perfect freedom through a vacuum, and to be impeded, but in an insensible degree, in their progress through air or any of the gases; they are also found capable of being transmitted, though in small quantities, through transparent media of the denser kinds, as glass, rock-crystal, &c.; and in passing through air they produce no sensible effect on the temperature of the latter. If a body be heated to any degree of temperature, and be placed in an absolute vacuum, it is evident that, in consequence of the repulsive power above mentioned, the heat must at length be entirely dissipated by the radiation merely; and if the body be placed in any fluid, it may be readily concluded that the abstraction of the heat must be influenced by the conducting power of the fluid.

The first direct experiments which appear to have been made on the radiation and reflection of heat are those of Mariotte, and an account of them is given in the 'Mémoires de l'Acad.,' 1682. He caused the heat of a fire to fall on the surface of a concave mirror, and observed that it was concentrated in the focus of the latter; and, on placing a plate of glass between the fire and the mirror, he perceived that the rays of heat were intercepted. The subject does not appear to have been much attended to till about the middle of the eighteenth century, when Lambert, in his 'Photometria' (1760), states that, on placing a large glass lens before a fire, the heat was scarcely sensible at the focus, while the reflected heat of burning charcoal set fire to combustibles at a considerable distance; and Scheele (a man who without any early education made many important discoveries while serving in the laboratories of his employers, the apothecaries of Gottenburg and Stockholm), in his treatise on air and fire, which appears to have been written in 1775, describes radiant heat as differing from ordinary heat by disseminating itself in right lines whose directions are not changed by the agitations of the air, and by being reflected from polished metallic mirrors, while it is absorbed in those of glass, and in the others when their surfaces are blackened.

The experiments of Scheele were varied by MM. Saussure and Pictet, who by an appropriate apparatus endeavoured to ascertain the laws of the radiation of caloric. They employed for this purpose two concave mirrors of polished tin, in the focus of one of which was placed the bulb of a Réaumur's thermometer, and in that of the other a ball of iron heated below the degree necessary to render it luminous; and, by a comparison of the height of the mercury in the thermometer with that in one which was placed out of the focus, but at an equal distance from the iron, the difference was found to be equal to about 8 degrees. M. Pictet employed also, in place of the heated ball, a glass flask containing boiling water, in order to avoid the risk of any light being combined with the heat; and the effect produced on the thermometer sufficiently proved that the calorific rays exist independently of those of light. (Pictet, *Essai sur le Feu*, 1790.) In pursuance of the experiments of Scheele with a blackened mirror, M. Pictet covered with lampblack the bulb of the thermometer in the focus of one of his mirrors, and found that the concentrated heat from the flask, which when the bulb was bright raised the mercury 2⅓ degrees, now raised it 4⅓ degrees. The same experimenter placed a flask of snow in the focus of one metallic reflector, and a thermometer in that of another; and the

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Fellow, after living for five years in England, preferred giving up the Fellowship to fulfilling the intentions of the founder by going abroad for the remainder of the time. It may be added that Radcliffe's bequest has been of very little use to medical science, as the only one of the Travelling Fellows (as far as the writer is aware) who has distinguished himself by his scientific writings is Sir John Sibthorpe, the author of the 'Flora Græca,' and founder of the Professorship of Agricultural Botany.

observed fall of the mercury was then considered as an indication that cold is susceptible of radiation and reflection like heat.

The nature of the apparatus, and the experiments made by Professor Leslie on the radiation of heat, are described in the article HEAT. From these it appeared that the amount of radiation from a polished surface was only about one-eighth of that which took place from a surface without polish; and hence it was evident that the velocity of radiation depends more on the surface than on the nature of the radiating body. In making experiments respecting the absorbing power of substances, Leslie found that when the heat from the canister was suffered to fall on the glass bulb of the differential thermometer, the quantity received by the latter, if covered with tin-foil having a polish, was only one-fifth of that which it received in its ordinary state.

Professor Leslie also repeated the experiments of Pictet for determining what was called the radiation of cold; and filling his canister with ice or snow, he found that the cold apparently emitted from the varnished side was the greatest, and that from the polished side the least; he observed also that the cold, like the radiant heat, varied with changes in the absorbent power of the thermometer and of the surface of the mirror. The mercury in the thermometer fell more when the mirror was of polished metal then when of glass; it also fell more when the bulb was in its ordinary state than when covered with a polished tin-foil. (*Inquiry into the Nature of Heat*, 1804.) These circumstances, which seemed at one time to favour the opinion that cold had a material existence like heat, have received an explanation from M. Prevost of Geneva. (*Journal de Physique*, xxxviii.) This philosopher observes that a mass of ice or snow may send out radiant heat less in abundance than that which is emitted from other bodies in its vicinity; and this comparatively small quantity of heat, when reflected from one mirror to the other, and from the surface of the latter to the focus, may there produce the effect of absolute cold, by causing the thermometer to send out radiant heat to the ice, and thus render the mercury in it lower than it would otherwise be. This interchange of caloric between the thermometer and the ice may be conceived to go on, the former on the whole losing, and the latter acquiring it, till an equilibrium is established between their temperatures.

From the results of the valuable experiments made by Professor Leslie, it is apparent that the power by which bodies absorb heat is directly proportional to that by which they allow it to radiate from them; and that both are inversely so to the power of reflecting it. When the rays of heat fall on polished glass, a large portion of them is absorbed, these raise the temperature of the glass, and from the surface of the latter that heat is afterwards radiated in abundance; whereas, when the rays strike the surface of polished metal, nearly all of them are reflected. It was found however that different metals, independently of their polish, have different degrees of reflecting and radiating power. A mirror of tin being rubbed with mercury, the reflection was increased in the ratio of 12 to 20, though the degree of polish was the same; and a metal having lost some of its brilliancy by oxidation, the radiating power was proportionally augmented.

Leslie's canister was found, moreover, to produce different effects, according to the thickness of the covering material on its sides. One coat of jelly on the tin side produced an elevation of the thermometer equal to 38°, and four such coats produced an effect equal to 54°; but after a certain thickness the difference was insensible. A plate of metallic leaf rendered however the radiating power as great as a thick plate of the same metal.

Experiments made by Count Rumford, soon after the publication of Leslie's work, produced nearly the same results as the latter had obtained; and the Count draws from them several useful conclusions. He observes (*Phil. Trans.*, 1804) that when we would confine heated substances, solid or fluid, in a vessel, the surface of the latter should be highly polished; on the other hand, if the object be to cool the substances, the surface should be painted or varnished, or be covered with a soft coating which is not metallic. Also, in warming apartments by steam, the intention being to promote radiation as much as possible, the tubes conveying the steam should be unpolished or painted.

In pursuing the views of Scheele concerning the transmission of heat through screens, Leslie found that a sheet of tin interposed between the canister and the mirror entirely intercepted the heat, and a plate of glass nearly so. Employing two sheets of tin, each of which had one side covered with black varnish, while the other side was polished, the following were the results: when the varnished sides were in contact, little heat passed through, evidently because one of the exterior sides was not well adapted to receive the caloric, nor the other to radiate the little which might have been acquired; but when the varnished sides were placed exteriorly, the quantity which passed through was considerable, the varnish enabling one plate easily to absorb and the other as easily to radiate the heat.

The reality of the transmission of heat through glass plates, which both Leslie and Dr. Brewster appeared to doubt, from the difficulty of distinguishing between heat so transmitted and that which radiates from the glass after having been for a time absorbed in it, is now supposed to be sufficiently established by the experiments of MM. Prevost and De la Roche (*Annals of Philos.*, 1803), and also by the researches of M. Melloni. (*Annales de Chimie*, xlviii., &c.) The first, in order to ascertain the fact, received on a thermometer the rays from a heated body after passing through screens of glass which were renewed so often that they had not time to become heated. The second suffered a thermometer to rise to its maximum by the rays from a heated body when a transparent glass screen was interposed; and again, when there was interposed a glass screen blackened so as to prevent the radiant heat from passing, the excess of the rise of the thermometer in the former case above that in the latter gave evidently the effect produced by the radiant heat alone. The conclusion at which the experimenters arrive is, that the quantity of heat which radiates through glass is so much the greater as the temperature of the source of the heat is higher. M. Melloni found that of 100 rays incident on the same plate of glass from an oil-lamp, from red-hot platinum, from copper heated to 734°, and from the same heated to 212°, the numbers were 77, 57, 34, and 12, respectively. He has also ascertained that all bodies which have the power of transmitting heat are in general more or less transparent; and that rock-salt is the only known substance in which all the radiant heat falling on it is either reflected or transmitted, whether the temperature of the heated body be low or high.

By letting the calorific rays pass first through one screen and then through two, M. De la Roche found that, in passing through the second screen, the rays suffered less diminution of intensity than in passing through the first; and the fact is considered as proving that some calorific rays experience more difficulty in passing through glass than others; consequently that, like light, radiant heat is of different kinds. He also observed that a thick plate of glass allows a smaller quantity of radiant heat to pass through than a thin one, and that the difference is so much the less as the temperature of the heated body is higher: and it is inferred that, since radiant heat becomes more capable of penetrating glass as the temperature increases, till the body becomes luminous, heat is only a modification of light.

The theory of radiant heat is intimately connected with that of the cooling of bodies; and the first effort to determine the laws relating to this subject was made by Sir Isaac Newton, who, from theoretical considerations, inferred that when a heated body is exposed to a constant cooling cause, as the uniform action of a current of air, it ought to lose at each instant a quantity of heat proportional to the excess of its temperature above that of the surrounding air, and consequently that its losses of heat in equal intervals of time should form a decreasing geometrical progression. But it is now known that this law holds good only when the differences of temperature do not exceed 40 or 50 degrees, and its inaccuracy at high temperatures was first pointed out by Martine (1740).

From the experiments of MM. Dulong and Petit, it is found that, if it were possible to obtain the absolute loss of heat which a body in vacuo experiences (or that loss which would take place if there were no restoration of heat from surrounding bodies), the velocities of cooling, estimated by the diminutions of temperature indicated by an air thermometer, would increase in a geometrical progression when the temperature of the heated body increases in an arithmetical progression; and further, that the ratio of the former progression (= 1·0077) would be the same for all bodies, whatever might be the state of their surfaces, and whether the temperature of the vacuum remained constant or increased in an arithmetical progression. But, on taking account of the quantity of heat sent back at every instant by the surrounding medium (a quantity which will be constant if the temperature of that medium does not vary), it is found that the velocities of cooling in vacuo increase, for equal increments of temperature, in a geometrical progression whose terms are diminished by a constant quantity, which quantity varies in a geometrical progression when the temperature of the medium varies in an arithmetical progression. By direct experiments on the cooling of heated bodies in air and hydrogen gas, Dulong and Petit determined what Professor Leslie had before ascertained by an indirect process, namely, that the loss of heat when a body is in contact with a gas is independent of the surface of the cooling body. They found also, by experiments on dilated air and carbonic acid at various temperatures, that the velocity with which a body cools from the mere contact with gas (when the excess of temperature of the heated body above that of the surrounding gas is constant) depends on the density and temperature of that gas; but this dependence is such that the velocity of cooling remains the same if those elements change in such a way that the elasticity of the gas remains constant. The same chemists have also ascertained that, when the elasticity of air varies in a geometrical progression, its cooling power varies likewise in a geometrical progression, in such a manner, that when the common ratio of the first progression is 2, that of the latter is 1·366. If, instead of common air, hydrogen gas, carbonic acid, or olefiant gas be in contact with the heated body, the ratio of the first progression being as before, that of the second is 1·301. And they conclude that the cooling power of each of the last-mentioned gases is nearly proportional to the square root of the elasticity of the gas. (*Annales de Chimie*, vii.; *Annals of Philos.*, xiii.)

That the colours of bodies have some effect on the velocity of radiation and on the absorption of heat has been proved by experiments made by Dr. Stark of Edinburgh (1833). This gentleman surrounded the bulb of a thermometer successively with equal weights of black, red, and white wool, and placed it in a glass tube, which was heated to the temperature of 180° by immersion in hot water; the tube was then cooled down to 50° by immersion in cold water, and the several times of cooling were respectively 21, 26, and 27 minutes. On winding successively black, red, and white wool about the bulb, and raising the temperature from 50° to 170°, the times in which the thermometer so surrounded acquired the latter temperature were respectively 4½, 5¼, and 8 minutes. (Turner's *Elements of Chemistry*, 'Heat.')

Having thus briefly noticed the reflection of radiant heat, its transmission through plates, and the laws of velocity with which bodies become cooled, we may conclude with a few words concerning its refrangibility. This subject was first examined by Dr. (afterwards Sir William) Herschel, who, having analysed by the prism, as usual, a beam of solar light, and having placed a Fahrenheit's thermometer successively within the fields of the different coloured rays in the spectrum, found that in the violet rays the temperature was 2°, and, gradually increasing towards the other extremity, in the red rays it was 7° above the general temperature of the apartment. He also ascertained that there was a point beyond the limits of the visible red rays at which the excess of temperature was a maximum. Similar observations were made about the same time by Sir Henry Englefield; and it was hence evident not only that the calorific rays were refrangible, but that the property existed in them in a higher degree than in light. Dr. Herschel afterwards made a number of observations on small pencils of heat proceeding from a lighted candle, a common fire, iron heated to redness, and also from iron heated to a lower degree; and he discovered that, in all these cases, the calorific rays were susceptible of refraction. He found however that there was some difference between the heat of the sun and that of terrestrial bodies, the former passing more freely through the glass than the latter. (*Phil. Trans.*, 1800.) M. Melloni has subsequently ascertained, by using prisms of rock-salt (a mineral which possesses in a high degree the power of transmitting heat), that heat from different sources, like light of different colours, has different degrees of refrangibility.

It ought to be observed that M. Berard, in a memoir on the physical properties of solar light, states that he found the point of greatest heat to be not beyond but within the red rays of the spectrum. But Sir David Brewster relates that Sir Humphry Davy discovered the cause of this difference, which is ascribed to the nature of the thermometer employed by the French chemist. On using slender thermometers with long bulbs, and [illegible]ed with air which was confined by a coloured fluid, Sir Humphry Davy obtained results which confirm the observations of Dr. Herschel and Sir Henry Englefield.

M. Berard ascertained that when light suffers double refraction in Iceland spar, the two pencils formed spectra which exhibited similar properties; in both, the calorific power differed at the two ends, and existed beyond the visible red rays. Also, on polarising by reflection from glass a beam of solar light, and receiving the reflected ray on a second glass, the latter being capable of turning round till the ray ceased to be reflected from it, he found that while the light was reflected, the heat was also reflected, and that when no light was reflected, there was no heat. The like effect was produced when, instead of a pencil of solar light, a portion of radiant heat from a body not luminous was employed, and the inference is, that the particles of radiant heat are polarised by reflection, like those of light. This subject has however been since more completely investigated by Professor Forbes. (*Edinburgh Phil. Trans.*, 1835.)

The subject of solar radiation, or of the direct force of the sun's rays, so important to the agriculturist as well as to the philosopher, has been treated by Mr. Daniell, in his 'Meteorological Essays,' 1823; and indeed to this gentleman we are indebted for nearly all that is known respecting it. On comparing a thermometer exposed to the action of the sun with one which gave the mean temperature of the air in the shade, Mr. Daniell observed that the power of solar radiation varies with the sun's declination; the greatest intensity taking place in June, though the greatest mean temperature of the atmosphere does not occur till July. He observed also that the radiation varies at different hours of the day, increasing with the sun's altitude till a short time after it arrives on the meridian, and then diminishing till the evening. From the observations of Captain (now Major) Sabine at Sierra Leone, at Bahia, and at Port Royal, Mr. Daniell has been led to conclude that the intensity of solar radiation diminishes in proceeding towards the equator; and the conclusion appears to have been subsequently confirmed by the observations of Captains Scoresby and Parry, and of Dr. Richardson, in the Arctic regions. From the observations of Captain Sabine on the mountains of Jamaica, Mr. Daniell considers that this radiation increases from the surface of the earth upwards.

Since all bodies, even in vacuo, lose heat by radiation, it is easy to conceive that any part of the earth's surface, when not exposed to the direct action of the sun, must emit calorific rays of heat towards the heavens, and thus must become cooled. This is called *terrestrial radiation*, and the subject has been particularly considered by Mr. Daniell, who, from observations continued during all the months of the year, found that the maximum depression of the thermometer, on account of radiation, varied from 10° to 17° between midwinter and midsummer; but that the mean depression was the least in January and July, and the greatest in April. It is obvious however that numerous observations are yet to be made in different regions of the earth before any general theory respecting the extent and law of the variations of solar and terrestrial radiations can be formed.

RADICAL. [Root.]

RADICO'FANI. [Siena, Province.]

RADISH. [Raphanus.]

RA'DIUS (a ray, the spoke of a wheel) means the line drawn from a point, consider[illegible] as a centre or pole, to any point of a curve.

RADIUS OF CURVATURE. [Curvature; Surface.]

RADIUS. [Skeleton.]

RADIX (root) is applied to any number which is arbitrarily made the fundamental number of any system. Thus ten is the radix of the decimal system of numeration, and the radix of the common system of logarithms. The term however has not acquired much fixed use, though often convenient for temporary specification of the use which i made of a particular number or fraction.

RADNOR. [Radnorshire.]

RADNORSHIRE, a county of South Wales, lying between 52° 2′ and 52° 28′ N. lat. and 2° 57′ and 3° 45′ W long. This county is of an irregular form, bounded on th north by Montgomeryshire and Shropshire, on the east and south-east by Herefordshire, on the south and south-west by Brecknockshire, and on the west by Cardiganshire. Its greatest length is from near Presteign, on the east, to the Cwmtoyddwr Hills, on the west, a distance of 31 miles. Its greatest breadth, from the hills in the parish of Beguildy, on the north, to the river Wye, near Gladestry, on the south, 26 miles.

Presteign, the county town, is 151 miles north-west from London, measuring by the mail-coach road, and about 120 in a straight line. It is the smallest of the six counties of South Wales, having a superficial extent of 426 square miles (being 184 miles less than Pembrokeshire, the county of South Wales next in size). Its population also is inferior to the other counties of South Wales: the Parliamentary Returns for 1831 state the total number of inhabitants to be 24,651.

Surface, Hydrography, &c.—Radnorshire is decidedly a mountainous county, but it would be difficult to say in what direction the hills generally extend. The highest range however, that of Radnor Forest, has an inclination from south-east to north-west. The Carneddu Hills and Llandegley Rocks have a similar direction; but, with these exceptions, it is in vain to lay down any general rules in regard to the line and grouping of the mountains of this county. One portion of Radnor Forest, lying between New Radnor and Llanvihangel Rhydithon, attains the height of 2163 feet above the level of the sea. Another point, called Whimble, is scarcely inferior, being 2100 feet high. The points next in elevation are Fron, 1850 feet; Fron-wen, 1800; Bach Hill, 1750: all of which are portions of the wild tract of land called Radnor Forest, situate on the eastern side of the county, parts of which, from the name and other circumstances, it is natural to suppose were covered with wood, although now producing nothing but moss and heath. It is the property of the crown, who appoints a forester to protect its interests. There are some hills (for they partake more of the character of hills than mountains) of considerable height in other parts of Radnorshire. The southern end of Rhydd Hywel, on the right of the road leading from Rhayader to Llanidloes, 1750 feet; Bryn Maen, in the parish of Llanvihangel Nantmelan, and Gwaun Ceste, in Glascwm parish, are each 1700 feet high; Gorstaden, near Llanbadarn Fynydd, is 1650 feet; Camlo Hill, near Abbey Cwm Hir, 1650 feet; and Cefu Craig-y-Foel, near Nant-gwylt, 1550 feet.

The general direction of the rivers and streams is to the south-east; and nearly all of them empty themselves into the Wye and its tributaries. The exceptions are, the Teme, and a small stream called Afon Tylwch, which takes its rise in the north-western part of the county, and runs into the Severn at Llanidloes in Montgomeryshire.

The Wye enters Radnorshire on the north-west, between Llangerrig and Rhayader, at a distance of about eighteen miles from its source on Plynlimmon. From two miles below Rhayader to the town of Hay it forms the boundary between Radnorshire and Breconshire, the former county being on the north-east and the latter on the south-west side of the river. The Wye then separates Radnorshire from Herefordshire, as far as the village of Rhydspence, where it quits the former county. The Elan is the first considerable stream that adds its waters to those of the Wye. Rising on the elevated ground on the borders of Cardiganshire, it takes a circuitous but rapid course easterly towards the Wye, which it enters on the right bank a short distance below the town of Rhayader. The scenery of the Elan is extremely romantic, and is finely described by the Rev. Wm. Bowles, in his poem of 'Combe Elain.'

The Ithon rises on the northern side of the county, adjoining Montgomeryshire, and takes a course directly south. It forms the drain for the central portion of the county; and before its junction with the Wye, on the left bank of that river, seven miles above the town of Builth, it becomes a stream of considerable size, having a course of 30 miles. The Elan and Ithon are the only two rivers which exclusively belong to Radnorshire. The Lug rises in the east portion of the county, and runs south-west to the town of Presteign, two miles below which it enters Herefordshire, and traversing the most fertile parts of that county, falls into the Wye four miles below Hereford. The source of the Teme is in the parish of Beguildy: running in a south-west direction by Knighton, it enters Herefordshire a short distance above the village of Brampton Bryan. In its course it serves as the boundary between Radnorshire and Shropshire.

The smaller streams of Radnorshire are the Somergel, Edw, Marteg, Clywedog, Arrow, and Bach-wy. The cataract called 'Water-break-its-neck' is formed by a branch of the first-named stream. The scenery on the Edw and Bach-wy, near their respective junctions with the Wye, is well worthy the traveller's attention. The Wye and Ithon abound with salmon. The fish of the other streams are principally trout and grayling.

The lakes, or pools of natural water, are neither extensive nor numerous. The largest is Llanbychllyn, situated in the hundred of Painscastle, between Llanbadarn-y-garreg and Llandewi-fach. It is one mile and a half in circumference. The most picturesque is Gwyn Llyn, about two miles west of Rhayader, on the old road to Aberystwith. There is a third pool, called Llyn-hilan, close to the turnpike-road leading from New Radnor to Builth. It is about a mile in circumference, and at a very considerable height above the adjoining valley.

The roads of this, like those of most other counties, have been considerably improved of late years. The improvements effected in Radnorshire are owing in some degree to the flourishing state of Aberystwith in Cardiganshire, and the estimation in which that town is held as a watering-place and fashionable summer resort, the main roads of this county forming a communication between Cheltenham, Worcester, Birmingham, &c. and the Cardiganshire coast. The road from Birmingham and Worcester to Aberystwith enters Radnorshire at Presteign. From that town there are two branches, the one through New Radnor and Llandegley, and the other, a line lately formed through the valley of the Lug, and uniting with the former at Penybont, on the western side of Radnor Forest: from thence the road runs through Rhayader and along the banks of the Wye, quitting Radnorshire at the distance of eight miles from the last-mentioned town. The Cheltenham and Hereford road enters the county at Stanner, and unites with the line just described, between Kington (Herefordshire) and New Radnor. The Cheltenham and Aberystwith mail travels this line throughout the year. Birmingham and Worcester coaches sometimes run during the summer months. The most romantic Radnorshire road is one formed through the exertions of W. Pugh, Esq., formerly of Kerry, which leads from Newtown to Builth, traversing the county from north to south, and for the greater portion of its length is carried along the banks of the Ithon. The road from Builth to Rhayader, on the Radnorshire side of the Wye, is also highly picturesque and interesting. A new line of road from the former town to New Radnor has lately been formed.

There is no water-communication of any description. The Radnorshire portion of the Wye is not navigable, and the other streams are too small or too rapid to admit of it. There is no canal in or through any part of the county. The Newtown and Montgomery Canal, in the latter county, however, is used for the exports and imports of the northern district of Radnorshire. There is a railroad from Kington in Herefordshire to the lime-works at Weythel and Old Radnor, a distance of four miles. It is principally used to convey lime and the coal used in burning it. The railroad from Kington communicates with Hay, Brecon, &c.

Geological Structure.—The principal portion of the county is composed of the strata forming the Silurian system; but on the west and north-west side of the county, the upper beds of the older rocks, composing the Cambrian system, make their appearance. These Cambrian rocks in Radnorshire have a general strike from north and south, or from north-east to south-west, and for the most part dip to the north-west. These rocks comprise perhaps one-fourth of the whole county, having in their extreme western and north-western limits a slaty character, which towards the interior or east is gradually changed to quartzose grit. The character of these rocks may be examined among the hills west of Llanbadarn-fynidd; along the Wye from Rhayader to Llangerrig, on the Aberystwith road; and in the romantic dingle of the Elan, where the strata are much contorted. They also form the summits of Camlo Hill, Ralt, Wenallt, Rhiw-graid, Gwastaden, Dol-fan, &c. Proceeding east, the river Ithon forms, nearly exactly, the line of junction of the Cambrian rocks with those of the Silurian system; the latter however encroach somewhat on the west of the Ithon as that river approaches the Wye.

The lower Silurian rocks do not make their appearance at this junction; the members of the upper Silurian system resting unconformably on the Cambrian rocks. These upper

Silurians compose (with the exception of the trap rocks of Llandegley, &c., and the strata interlaced with them) the whole of the middle portion of the county; but the total absence of the two limestones of the system renders it impossible to distinguish with any accuracy between the different formations. There is no trace of the Wenlock limestone to define the boundary between the shale and the lower Ludlow rock, neither any Aymestry limestone to separate the lower from the upper Ludlow rock. The strata vary in direction from north-east and south-west to north-west and south-east. Radnor Forest is included in this district, and is chiefly composed of the upper Ludlow rock. The summit is a gritty sandstone, representing, according to Mr. Murchison, the lowest beds of the old red-sandstone.

On the eastern side of the county, at Old Radnor, and in the neighbourhood of Presteign, the strata are more varied and interesting. The trap rocks at the former place have brought to light the rocks both of the upper and lower Silurian system. At Nash and Corton, between Old Radnor and Presteign, the Caradoc sandstone may be seen highly inclined, and forming an anticlinal ridge, the beds dipping north and south, and throwing off on each side the Wenlock limestone and shale: characteristic fossils of these formations may be collected at Corton, Nash, and Woodside. 'There is not,' says Mr. Murchison, 'perhaps in Great Britain, a finer mass of altered and crystalline limestone than that exhibited at Nash Scar, the principal cliff of which rises to the height of 200 or 300 feet above the adjoining valley of Knill and Presteign.' This limestone is well developed at Old Radnor, where also traces of the lower Silurian rocks may be observed. The great tract of old red-sandstone, occupying the counties of Hereford, Brecon, &c., extends into Radnorshire, and occupies a considerable portion of the south-eastern part of the county. It enters Radnorshire at Llanstephen on the Wye, and extending eastward leaves the county near Huntingdon. Besides this extension of the great formation, there are three outliers of old red-sandstone of inconsiderable extent, and separated from the principal tract by the Ludlow rocks. The first lies between Presteign and Knighton, comprising an area of about five square miles. The second is situated west of Presteign, occupying the western side of Nash Scar, and appearing again on the high ground between Presteign and Harley Hill. This outlier is separated from the first by the valley of the Lug. The third is a long narrow slip between Old Radnor and Gladestry, on the east side of Colva Hill. The strata of these three outliers are all more or less inclined, and attain considerable elevations.

The chief mass of trap rocks in Radnorshire is situated near the centre of the county, having a direction from north-west to south-east, and extending from Llandegley and Llanbadarn-fawr, on the north and north-east, to the neighbourhood of Builth on the south-west, being in length about ten miles and in breadth five; forming the Llandegley rock, and the ridges of Sunny-bank, Gelli, and the Carneddau. Parallel to the main ridge, on the eastern side, are a number of smaller elongated mounds of trap running in the same direction, and besides these there are numerous *stratified* traps, alternating with beds of marine deposit. Mr. Murchison enumerates twelve of these bands of bedded trap in a section of only 350 feet in length. The stratified rocks associated with the trap are various shales, flags, &c., but principally a dark-coloured shale, representing probably the Wenlock shale; all of them much altered by the action of the intrusive igneous rock. The stratified traps consist of felspar, and of quartz, rather porphyritic, and containing crystals of iron pyrites and some carbonate of lime. Mr. Murchison compares this district to the tract of Shelve and Corndon in Shropshire. The trap in the vicinity of Old Radnor before alluded to occupies two parallel ridges: the eastern, three miles in length, comprising Stanner Rocks, Worsel Wood, and Hanter Hill; and the western, called Old Radnor hill, about half the length of the other. The trap of the first ridge passes from a coarse crystalline hypersthene rock into fine-grained greenstone, and resembles the hypersthene rock of Coruisk in the Isle of Skye. The mass of Old Radnor hill is a dark greenstone, but there is a peculiar conglomerate thrown off on the western flanks, having a base of grey and green felspar, enclosing pebbles of quartz, some of a large size. 'From this composition,' says Mr. Murchison, 'it may be inferred that a stream of compact felspar, or submarine lava, entangled in it the sand and pebbles of a former bed of the sea.' It is a stratified deposit, occupying the same place in the series as the volcanic grits of the Caradoc which underlie the Wenlock limestone. The trap may be seen in many places in contact with and penetrating the Wenlock limestone, which close to the junction is completely unstratified. Minute veins of copper-ore and crystals of copper and iron pyrites occur in the altered bedded rocks, as well as nests and coatings of anthracite. There are various proofs that the volcanic rocks penetrated the limestone posterior to its consolidation. Mr. Murchison compares the phenomena at Old Radnor to those of the Val di Fassa in the Tyrol, the latter however being on a much larger scale. The intrusive volcanic rocks do not appear at the surface at Nash, but there is every proof of their immediate vicinity, and the Corton conglomerate strongly resembles a volcanic grit. There is another ridge of trap rock called Baxter's Bank, situated a few miles north-west of the Llangedley trap, parallel to it, and near the junction of the Cambrian system with the Silurian, which presents similar phenomena of altered and dislocated strata to those before mentioned. The superficial deposits are composed of the detritus of the adjacent rocks, and bear evident tokens of a drift from the north-west to the south-east.

Although all the strata of the county are inferior to the carboniferous rocks, yet many attempts have been made and are still in progress in search of coal, which the majority of the inhabitants believe to exist under the surface. The principal cause of this delusion has been the dark lead-coloured appearance of the shale before mentioned as existing in the neighbourhood of the trappean rocks; and accordingly, where the trap rocks protrude, levels are driven and shafts sunk, while a slight acquaintance with the principles of geological science would show such attempts to be utterly hopeless.

The medicinal springs of Llandrindod, Llandegley, and Blaen Edw all issue from the altered strata in junction with the trap rocks of the district, and, like the mineral springs in Brecknockshire, are supposed to owe their origin to the decomposition of iron pyrites and other mineral ingredients. There are three springs at Llandrindod, viz. a saline, chalybeate, and sulphur. The Llandegley and Blaen Edw waters are sulphurous. Llandrindod is much frequented in the summer months, and lies on the Builth and Newtown road, about seven miles from the former town. There are other medicinal springs in the county, but they are chiefly used by persons residing on the spot.

Surface and Agriculture.—A great portion of the county consists of common, bog, and moor land, and is therefore comparatively useless for agricultural purposes. It is supposed that nearly two-thirds of the county are unenclosed, but it is probable that were the population greater, the amount of waste land would be greatly diminished, as a large part merely requires to be enclosed to render it fit for profitable cultivation; while other portions, too steep or too exposed for agricultural purposes, might be successfully planted. The proportion of waste land however has been greatly diminished of late, as enclosures are gradually making, as well as considerable plantations of larch and fir; and a bill has lately passed through parliament for enclosing the waste land of three parishes, and this will probably be followed by others. But the waste lands, even in their uncultivated state, are of great value as sheep-walks, and as about one fourth only of the enclosed land is under the plough, and many of the pastures (owing to the scarcity of manure and the want of an efficient system of draining) are barely superior to the common land, the policy of making extensive enclosures at present may well be questioned, especially as the expense of enclosing is nearly equal to the value of the fee-simple of the land. Planting however cannot be too much encouraged. Many of the manors (so called) were until lately in the hands of the crown; but most of them have been sold by the Commissioners of Woods, Forests, and Land Revenues, to private individuals, which has been the cause of considerable hardship to many poor persons residing within the manors on spots of ground formerly enclosed from the waste, and since claimed by the new proprietors of the manors.

Notwithstanding the thin population, the quantity o wheat grown in the county is considerably less than the consumption. The best wheat is grown on the eastern and south-eastern districts. Barley and oats are grown in considerable quantities on nearly all the farms. Potatoes ar cultivated to some extent, and flax in small patches fo home use. There are no hops grown in any part of th county. For purposes of sale, the main dependence of the Radnorshire farmer is on the stock reared on the pasture and common land; the latter not only support large quantities of sheep, but, in the most sheltered parts, cattle of all sorts. The cows are principally of the Herefordshire breed; the black Cardiganshire cattle are not extensively bred here. Numbers of Welsh ponies are also reared on the commons. Salt butter for winter use is an article of export. A scarcity of manure retards the improvement of the land. There is excellent lime at Nash and Old Radnor; but these places being situated on the border of Radnorshire, it has to be carried a great distance, and by hilly roads, to reach the interior and opposite districts of the county. Irrigation is universally adopted with the most beneficial results.

There is little cider fruit grown; the small quantity that there is, is confined to the parts adjoining Herefordshire. The quantity of rain and the damp fogs of the winter months, in the vicinity of the hills, seem to engender a moss on the young apple trees planted as an experiment, which soon proves destructive to their fructification if not to their growth.

The farms are of various sizes; but it may be observed that the homesteads on the largest are generally much inferior to those of Herefordshire and other English counties.

Divisions, Towns, &c.—Radnorshire is divided into six hundreds, exclusive of the borough of Radnor, and contains fifty-two parishes and three market-towns.

Hundred.	Situation.	Population.
Colwyn . . .	South and Central . .	2,632
Kevenlleece .	Central	3,135
Knighton . .	North-east	5,213
Painscastle . .	South	4,226
Radnor . .	East and Central . .	2,544
Rhayader . .	West and North . . .	4,440
Radnor Borough	Central	2,461
	Total . . .	24,651

Presteign, the capital town, is situated in the hundred of Radnor, at the extreme eastern verge of the county, and is 151 miles north-west from London. The nearest road from Birmingham and Worcester to Aberystwith lies through this place. The valley in which the town stands is fertile, and watered by the Lug. Under the Reform Act it is a contributory borough with New Radnor, &c. in the election of a member of parliament. The boundaries of the borough for that purpose were settled by the 2 & 3 Will. IV., c. 64. It is in the diocese of Hereford. The derivation of the name Presteign is not known: the Welsh name is Llan Andras (the church of St. Andrew). The town is supposed to owe its rise to Martin, bishop of St. David's in the thirteenth century. The parish registers in existence commence as early as the year 1561. In one of them there is an entry stating that Charles I. passed two days and nights in a house in the parish, and from thence proceeded to Chester. The town now consists of four principal streets. The assizes and quarter-sessions are held here. The shire hall and county gaol are modern buildings. The market-day is Saturday. Fairs:—Sat. before Feb. 13, May 9, June 20, and October 13. The living is a rectory, with the chapelry of Discoed annexed, and the net value is returned at 795*l*. There are dissenting chapels of Wesleyan and Primitive Methodists: the Baptists also have a place of meeting. The church contains a curious and beautiful piece of tapestry placed over the altar, representing Christ's entry into Jerusalem.

The public walks, called Warden, are prettily situated on an eminence north-west of the town. The ground was presented to the inhabitants by the present earl of Oxford. The summit is supposed to have been the site of a castle; but, if any did exist, not a vestige now remains. There are no manufactures of any description here. The population of the entire parish, which is partly in the hundred of Wigmore, Herefordshire, in 1831, was 2282. The number of electors being 10*l*.-householders, registered September, 1839, was 91.

John Beddowes, a clothier, who lived in the reign of Elizabeth, founded a free grammar-school here, and endowed it with 140*l*. a year. The number of scholars in 1835 was fifty-four. The schoolmaster is elected and the scholars admitted by a body of governors or trustees, under the terms of the bequest. The instruction is in reading, writing, and arithmetic. The books are supplied by the parents. There is a Sunday-school in connection with the Established Church, supported by subscription, with 100 scholars of both sexes. The teaching is undertaken by gratuitous instructors. There is also a Sunday-school connected with the Wesleyan Methodists. Besides these, there are several petty day-schools for boys and girls; but the education comprises nothing but reading and writing, and even this much is taught indifferently. The instruction is at the expense of the parents.

Presteign is the centre of a poor-law union consisting of nine parishes.

At Presteign was born Richard Lucas, the author of the 'Enquiry after Happiness,' who also acquired considerable reputation as a divine in the latter part of the seventeenth century. He was born in 1648, and entered a student at Jesus College, Oxford, in 1664, being then sixteen years of age. After proceeding in both degrees in arts, he took orders. His first appointment was to the mastership of the free grammar-school at Abergavenny; but being shortly after presented to the vicarage of St. Stephen's, Coleman Street, he removed to London. His great popularity as a preacher obtained for him the lectureship of St. Olave's, in the borough of Southwark, where he succeeded Dr. John Meriton, in October, 1683. Besides the 'Enquiry after Happiness,' he published some single sermons. Towards the latter part of his life he became totally blind. (*Beauties of England and Wales.*)

Knighton, the town next in size to Presteign, is situated six miles north of the latter place, in the hundred of Knighton, on the borders of Shropshire, from which it is separated by the river Teme, which enters Herefordshire about four miles below. The Welsh name is Tref-y-clawdd, which signifies 'the town upon the dyke,' Offa's Dyke running close to the town. [WALES.] The population of the parish in 1831 was 1259. This was, before the Reform Act, and still is, a contributory borough with New Radnor, &c. in returning a member to parliament. The town is awkwardly situated, being built on the side of a steep hill. The market is on Thursday, and is well attended by the neighbouring farmers. The living is a perpetual curacy, valued at 155*l*. per annum; patron, the warden of Clun Hospital. There was formerly a castle in a commanding situation at the upper part of the town, but it is now entirely destroyed. There are three infant-schools and seven small day-schools; one of the latter endowed with 4*l*. per annum. In the others the children are taught at the expense of the parents. There are also two Sunday-schools, with 100 scholars.

Rhayader, the third market-town, lies in the hundred of the same name, and in the diocese of St. David's, on the banks of the river Wye; and the original name was Rhaiadyrgwy, which signifies the 'fall of the Wye.' Before the present bridge of one large arch was erected, there was a considerable fall of water, but the channel was then deepened and cleared. Rhayader is on the western side of the county, adjoining Cardiganshire, and is 28 miles distant from Presteign, which, as before stated, is situated on the eastern border. The road from Birmingham, Worcester, and Cheltenham to Aberystwith is through this place. Rhayader derived antiently its chief importance from its castle, of which no vestige remains excepting the fosse, which was excavated out of the solid rock. It was very favourably situated on a precipitous point of land which projects into the channel of the river on the north of the town. This fortress was built about 1178, by Rhys-ap-Gruffyd, prince of South Wales, in order to check the depredations of the Norman freebooters.

The town is miserable and dirty in its appearance. The market-day is Wednesday. It is contributory with New Radnor, &c. in returning a member to parliament. A manufactory of flannel and coarse cloth is carried on here, but on a very small scale, twenty-two being the number of persons returned in 1831 as engaged in manufacture. The population (parochial chapelry) in the same year was 659. The living is a perpetual curacy, valued at 75*l*. per annum. The Methodists are numerous, and the Presbyterian Independents have lately erected a chapel. There are five day-schools, one of which is an endowed grammar-school: two others belong to Dissenters, viz. Independents and Calvinistic Methodists: three Sunday-schools, one of which, belonging to the Wesleyan Methodists, is said to consist of 45 males and 42 females; another to Independent Dissenters, of 140 children: and the other to Calvinistic Methodists, of 90 males and fe males. These Sunday-schools are supported by their respective congregations. It is probable that many children attend two of these schools, by which an error has crept into the Parliamentary Returns. A mechanics' association has lately been established.

New Radnor, or Maes-yfed Newydd, formerly the capital of the county, and a place of some consequence, is now degenerated into a village, and, but for some privileges which are still retained by the inhabitants, would not be worth noticing. The borough of New Radnor comprises about one-fifth of the county, and includes the parishes of New and Old Radnor, Llanvihangel, Nantmellan, and part of Cascob. Meredydd ab Owain destroyed the town about the year 900. It was again burnt in the reign of Henry IV., and was never restored to its former state. Being a station of considerable importance in guarding one of the principal passes into the territory of the Welsh princes, it was particularly liable to these vicissitudes. Its present condition may be ascribed, first to its ceasing to be kept fortified and garrisoned as a frontier town, its proximity to Presteign and Kington, and its cold situation and the scarcity of fuel. The walls of the castle may still be traced upon a height north of the village. The burgesses and freemen of this borough, and (since the Reform Act) 10*l*.-householders, vote in the election of a member of parliament. The total number of electors in 1832 for the united boroughs of New Radnor, Presteign, Knighton, Rhayader, Kunklas, and Cefu Llys were,—freemen, 276; 10*l*.-householders, 253: total constituency, 529. The corporation consists of 25 capital burgesses, who are the common council and governing body; a bailiff, two aldermen, a recorder, town-clerk or prothonotary, a receiver, auditor, two chamberlains, two serjeants-at-mace, and an indefinite number of free burgesses.

Under the terms of the charter, the borough magistrates have equal power with county magistrates in the trial of felonies and other crimes and misdemeanors, and a court of quarter-sessions is accordingly held in the borough, the recorder, bailiff, or senior magistrate presiding; but the majority of offences committed within the borough are disposed of at the county sessions, under the 5 Geo. IV., c. 85. There is also a Court of Record held weekly for the recovery of debts under 40*s*. The county courts of the sheriff for the recovery of debts under 40*s*. are held here and at Presteign alternately. The market has long been discontinued, but sveral fairs are still held here in the course of the year. The population of the parish, in 1831, was 472. The living is a rectory, valued at 304*l*. per annum. There is one daily school for children of both sexes, partly supported by an endowment of 10*l*. a year for the instruction of twenty children, partly by a donation of 5*l*. from the member for the borough, for the instruction of five others; the rest are paid for by their parents. There are also a small school held three times a week for girls to learn to sew and knit, and also to spell, and one Sunday-school, with about 70 children, the teaching in which is principally gratuitous.

Old Radnor, or Maes-yfed Hen, called also Pen-y-Craig, or 'the summit of a rock,' stands on an elevated situation, about two miles south east of New Radnor. The parish of Old Radnor is extremely large, comprising six townships. The population in 1831 was 1458. The church is prettily situated, and contains a curiously carved wooden screen. The six bells are noted for the richness of their tones. The living is a rectory, valued at 108*l*. per annum. Camden supposed Old Radnor to have been the Magnus of Antoninus, but this is now discredited. Sir Richard Hoare identifies the castle (of which there are at present no remains) with the Cruker Castle of Giraldus, this name being an easy corruption of crug or craig.

The peculiarities of Old Radnor in a geological point o view have been already noticed.

Division for Ecclesiastical and Legal Purposes.—The eastern side of the county is in the diocese of Hereford, and the western in that of St. David's; the former comprising the parishes of Presteign, Old and New Radnor, Norton, and Knighton. The parishes are, as before stated, 52 in number, viz. 14 rectories, 16 vicarages, and 22 perpetual vicarages.

The county is in the South Wales circuit. The assizes are held at Presteign, from which place the judge proceeds to Chester, and there meets the judge of the North Wales circuit. The legal jurisdiction of the borough of New Radnor has been noticed.

One member of parliament is returned for the county, no alteration having been made in this respect by the Reform Act. One member is also returned for the borough of New Radnor, in conjunction with the boroughs of Knighton, Rhayader, Kevenlece, and Kunklas, and the town of Presteign, the latter place being added by the Reform Act. The place of election for the county is Presteign; the polling-places are New Radnor, Presteign, Rhayader, Painscastle, Colwyn, Knighton, and Penybont. The election for the boroughs is held at New Radnor.

History, Antiquities, &c.—Radnorshire originally formed part of the territory inhabited by the Silures, and, after its subjugation and ultimate abandonment by the Romans, was included in one of the petty principalities into which Wales was divided, and the history of Radnorshire is naturally merged in that of Wales. The two principal events relating to it are, the conquest of it by Caradoc Vraich Vras, and its subsequent subjugation, in the beginning of the tenth century, by Elystan Glodrydd, who fixed his residence there. After the Norman conquest, it became the prey of the Norman adventurers, who obtained a settlement in the counties of Hereford and Brecknock; but principally of the Mortimer family, and afterwards of that of De Breos, who at one period held large possessions there. In the reign of Henry VIII., Radnor was formed into a county.

The Welsh name for this county, Maeshyved, is supposed to be derived from Hyfaidd, one of the sons of Caradoc Vraich Vras, before mentioned, who formed this portion of it into a lordship for his son.

That the Romans penetrated far into the county seems to be satisfactorily ascertained; for although the supposition of Camden that Old Radnor was the Magnus of Antoninus is now generally discredited, yet there is a Roman station at Cwm, situated on the right bank of the river Ithon, about midway between Llanbadarn-fawr and Disserth, and two miles north-west of Llandrindod. The form of the camp is a perfect square, including an area of about four acres. Forest Colwyn, or Columwy Castle, on the road leading from New Radnor to Builth, and in the parish of Llansaintfraed, also appears to be of Roman origin. It is also sometimes called Maud's Castle; a name derived, it is said, from Maud de St. Waleri, the wife of William de Breos, who at one period owned this place. Radnorshire being a border county, the remains of British encampments are numerous, especially on the eastern side adjoining Herefordshire.

Offa's Dyke, the boundary formed by Offa between his kingdom of Mercia and the territories of the Welsh princes, enters Radnorshire on the north at Knighton, and the turnpike road leading from that place to Presteign crosses it twice. The latter town lies about four miles on the English side. Running south, it enters Herefordshire at Berva Bank, a steep hill on the right of the turnpike-road between Presteign and New Radnor. On this hill are the remains of an antient fortification, probably erected to defend this boundary. The dyke can be easily traced on the high uncultivated ground, but in the valleys it is nearly obliterated. In addition to mere encampments or temporary entrenchments, there were several castles in this district, but their remains are very imperfect. One tower of Aber Edw castle remains. It is situated close to the romantic village of Aber Edw, near the junction of the Edw with the Wye, about six miles below the town of Builth. This castle belonged to Llewellyn ap Griffyth, and was that prince's last retreat. He came hither from Snowdonia, in 1282, to obtain assistance against Edward I.: finding however that Edmund Mortimer and John Giffard had marched with troops from Herefordshire to meet him, he retreated with his followers to Builth, where he crossed the Wye, but was refused admittance into the town by the garrison. He then ascended the Irvon, and stationed his followers on the northern side of the river. Llewellyn was here attacked unarmed, and killed by one Adam de Francton. [BRECKNOCKSHIRE.]

No vestige of the walls of the castle of New Radnor remains, but it appears to have been a place of some strength and of great importance, as it commanded one of the passes from England into Wales. Old Radnor was burned in 1216 by King John, in revenge for an insurrection of Llewellyn, prince of North Wales, and his son-in-law Reginald de Breos; and New Radnor, as already observed, was destroyed in the reign of Henry IV.

The battle of Pilleth, fought between the earl of March and Owen Glendower, occurred on a hill near Knighton, and takes its name from the little village of Pilleth.

The only monastic establishment in Radnorshire seems to have been that of Abbey Cwm Hir, or the Abbey of the White Monks. It is romantically situated in a narrow valley surrounded by high hills, in the north-western portion of the county, to the left of the road leading from Llandewy to Newtown. Leland ascribes the foundation of it to Cadwaltulan, or Cadwallon ab Madoc; and the 'Monasticon' assigns to it the date of 1143. Cadwallon was about this period the lord of the province of Machinydd, in which it was situated. The monastery was dedicated to St. Mary, and originally endowed for sixty monks of the Cistercian order, but it contained only three when the establishment was broken up, and was granted, 37th Henry VIII., to Walter Henley and John Williams. The only remains of the edifice are part of the exterior walls and the foundation of the pillars which supported the arches; from these there appears to have been one continuous building of 255 feet in length by 73 in width, exceeding in length, according to Leland, any other church in Wales. Some of the columns and arches of the abbey were removed to Llanidloes, and may be now seen in the church of that place. [Montgomeryshire.] The antient font and screen at Newtown were also taken from Abbey Cwm Hir.

Statistics.

Population.—Of 6269 males of twenty years of age and upwards, 4394 were, in 1831, employed in agriculture. The number of occupiers not employing labourers and of occupiers who do employ labourers is nearly equal, the numbers of the former, according to the census, being 911, and of the latter 1032. The number of agricultural labourers was 2451. There were a few weavers in the county, but the number of persons returned as employed in manufactures, or in making manufacturing machinery, was only 42; but there were 232 labourers employed in non-agricultural occupations.

The population of Radnorshire at each of the four following periods was—

	Males.	Females.	Total.	Increase per Cent.
1801	,,	,,	19,050	
1811	,,	,,	20,900	9·71
1821	11,266	11,193	22,459	7·45
1831	12,453	12,198	24,651	9·76

showing an increase between the first and last periods of 5601, or nearly 27 per cent., which is less than any other county, with the exception of Merionethshire; but in Radnorshire the rate of increase has been more uniform. In the first thirty years of the present century the population increased less than might be inferred from the number of the births, and there is no doubt that many natives of the county migrate to other parts. In the ten years ending 1831, the number of registered baptisms was 6571, marriages 1653, and deaths 3651. From 1813 to 1830 nine centenarians died, namely, two aged 100, one aged 101, two aged 102, and one each respectively aged 103, 104, 105, and 108.

The following table contains a summary of the population &c. of every hundred at the census in 1831:—

HUNDREDS AND BOROUGH.	HOUSES.				OCCUPATIONS.			PERSONS.			
	Inhabited.	Families.	Building.	Uninhabited.	Families chiefly employed in Agriculture.	Families chiefly employed in trade, manufactures, and handicraft.	All other Families not comprised in the two preceding classes.	Males.	Females.	Total of Persons.	Males, twenty years of age.
Colwyn (Hundred) .	481	545	—	24	411	92	42	1,343	1,289	2,632	651
Kevenlleece ,, .	518	591	1	17	431	83	77	1,584	1,551	3,135	829
Knighton ,, .	929	1024	4	32	548	250	226	2,659	2,554	5213	1302
Pains-Castle ,, .	766	852	5	21	592	180	80	2,126	2.100	4,226	1092
Radnor ,, .	493	526	—	23	290	143	93	1,250	1,294	2544	604
Rhayader ,, .	806	870	5	35	561	180	129	2,219	2,221	4,410	1156
Radnor (Borough) .	444	471	3	12	302	100	69	1,272	1,189	2,461	636
Totals .	4437	4879	18	167	3135	1028	716	12,453	12,198	24,651	6269

County Expenses, Crime, &c.—In the three years 1748-49-50, the average sum assessed annually for poor's rate was 1117*l.*, and the sum expended for relief amounted to 957*l.*; in the three years 1783-4-5 the annual assessment averaged 4448*l.*, and the expenditure for the relief of the poor 3889*l.* The sums expended for the maintenance of the poor in the several under-mentioned years were—

	£	Per head. s.	d.		£	Per head. s.	d.
1811	12,065 .	11	6	1835	11,517 .	9	4
1821	11,974 .	10	7	1836	10,853 .	8	7
1831	13,571 .	11	0	1837	9,965 .	8	1
1834	13,072 .	10	7	1838	8,266 .	6	8

From 1811 to 1838 the population had increased about 25 per cent., while the sum required for the relief of the poor had decreased 32 per cent.; and comparing 1838 with 1834, there has been a diminution of expenditure under this head amounting to 4806*l.* or 38 per cent. The whole of the parishes in the county are in unions under the provisions of the Poor-Law Amendment Act. In 1835-6 the number of bastards chargeable to parishes in the county was 417, or 1 in 59 of the total population, the proportion for Wales being 1 in 139, and for England 1 in 215. The numbers affiliated in the former of these years was 110, and in the latter 92. In 1830 the number of illegitimate births to the total number of births was 1 in 7, being a higher average than for any part of the kingdom, the proportion for Wales being 1 in 13, and for England 1 in 20.

The sum raised in the county for poor-rate, county-rate, and other local purposes, in 1833, was 17,045*l.*, levied upon the following descriptions of property:—

On land . .	£15,943
Dwelling-houses. .	1,033
Mills, factories, &c. .	23
Manorial profits, navigation, &c.	45
Total	£17,045

Under the property-tax the county was assessed in 1815 at 10,357*l.*, namely, property from lands 90,652*l.*, houses 1966*l.*, tithes 10,960*l.*: the property assessed to the occupier was 90,524*l.* The annual profits of trade were assessed at 3,714*l.*

The total receipts and expenditure under the head of county-rate were as follows in each of the under-mentioned years:—

	1792. £	1801. £	1811. £	1821. £	1831. £	1838. £
Total receipts .	220	894	932	1795	2420	2251
Expenditure .	307	983	762	1986	2692	1988

The receipts and expenditure on account of church-rates in 1839 were as follows:—amount received 662*l.*, namely, church-rates 637*l.*, from other sources 25*l.*, expenditure 665*l.*, of which 255*l.* were laid out in the repair of churches.

In the three years ending October, 1812-13-14, the length of paved streets and turnpike roads in the county was 76 miles; and the length of all other highways used for wheel carriages was 410 miles. The amount levied annually for the repair of highways in the above years was 166*l.*; compositions in lieu of statute labour, 281*l.*: making the total sum received by surveyors of the highways 447*l.* annually. The value of statute labour performed in kind was estimated at 1313*l.*, and the total sum expended in money and the estimated value of statute labour was 1767*l.* In 1839 the expenditure on highways amounted to 1980*l.*, length of roads 478 miles; cost of repair per mile 4*l.* 2*s.*, the average for Wales being 11*l.* 3*s.*

There are only two turnpike trusts in Radnorshire. In 1835 the income from tolls was 1582*l.*, parish composition in lieu of statute duty 713*l.*, estimated value of statute duty performed 565*l.*: total income 3347*l.* The expenditure amounted to 3318*l.*; there were debts incurred to the amount of 17,233*l.*, of which 14,471*l.* were bonded or mortgage debts.

Crime.—The number of persons charged with criminal offences and committed in the three septennial periods ending 1820, 1827, and 1834, was 67, 76, and 96, making the annual average of the three periods respectively 9, 11, and 13. The average of the six years from 1834 to 1839 was 18; and the numbers committed, convicted, and acquitted in each year were as follow:—

	1834.	1835.	1836.	1837.	1838.	1839.
Committed .	18	15	15	18	15	31
Convicted .	13	10	8	10	8	15
Acquitted .	5	5	7	8	7	16

During the above six years the number of male offenders was 89, females 23; but the number of the latter in 1839 was only one short of the number in the preceding five years. In 1834 (an average year) the number of criminal offenders to the population was 1 in 1369, being higher than any Welsh county, with the exception of Monmouth, Denbigh, and Glamorgan; in 1835 the proportion in Radnorshire was 1 in 1643, the proportion for England and Wales being 1 in 631. In so small a population it would not be satisfactory to give the average proportion of crimes committed, the ages of the offenders, and the degree of instruction which they have received, as the results could not be safely depended upon; but it may be stated, on a review of the absolute numbers in the tables of each year, that juvenile crime is comparatively rare, that the majority of offences are those against property committed without violence, and that of the offenders a larger proportion are totally uninstructed than in the whole of England and Wales.

Of the 31 persons committed in 1839, one male and one female were above 12 and under 16; nine males and eight females were between 16 and 21 years of age; and the remainder were of various ages between 30 and 60. There were 4 males and 6 females who could neither read nor write; 15 males and 5 females could read and write imperfectly, and the degree of instruction was not ascertained in one case. The nature of the offences was as follows:—5 were offences against the person (4 were assaults), 2 against property attended with violence, 23 against property unattended with violence (22 being cases of simple larceny), and 1 offence against the laws relating to forgery and the currency: there was not one person charged with malicious offences against property. Of the 15 persons convicted, two were transported, and 13 imprisoned, fined, or whipped.

The number of parliamentary electors registered to vote for the county was 1857 in 1835, and 2034 in 1839. During these four years the number of registered occupying tenants at a rent of 50*l.* per annum had increased from 521 to 572.

There is no savings' bank in the county.

Education.—The following summary is taken from the Parliamentary Returns of 1835:—

	Schools.	Scholars.	Total.
Infant Schools	4		
Number of infants at such schools; ages from 2 to 7 years . .		31	
Daily schools	59		
Number of children at such schools; ages from 4 to 14 years:—			
Males . .		282	
Females . .		231	
Sex not specified .		930	
Schools . . .	63		
Total of children under daily instruction			1,474
Sunday-schools	35		
Number of children at such schools; ages from 4 to 15 years:— .			
Males . .		301	
Females . .		394	
Sex not specified .		821	
•			1,516

Maintenance of Schools.

Description of Schools.	By endowment.		By subscription.		By payments from scholars.		Subscrip. and payment from scholars	
	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.	Schls.	Scholars.
Infant Schools	—	—	—	—	4	31	—	—
Daily Schools	12	255	2	77	41	963	4	138
Sunday Schools	1	40	31	1,347	1	26	2	103
Total.....	13	305	33	1,424	46	1,020	6	241

The schools established by dissenters included in the above statement are:—

	Schools.	Scholars.
Infant-schools . .	1, containing	13
Daily-schools	3 .	88
Sunday-schools . .	10 .	552
The schools established since 1818 are—		
Infant and other daily schools .	22 .	447
Sunday-schools . .	30 .	1341

No boarding-schools are included in the number of schools given as above; and there does not appear to be any Lancasterian school in the county. Of Sunday-schools 5 are returned from places where no other schools exist, and the children (138) did not probably attend any other school; 4 schools, attended by 129 children, are both day and Sunday schools, and duplicate entries are made to that extent; but how far this may have been done in other cases cannot be ascertained from the Parliamentary Returns. None of the schools in the county appear to be for the exclusive use of any particular sect. There are no lending libraries attached to any of the schools.

RAEBURN, HENRY, the son of a manufacturer at Stockbridge, near Edinburgh (which now forms part of that city), was born there on the 4th of March, 1756. He lost both his father and mother whilst young, and was apprenticed by his elder brother to the business of a goldsmith. During the time of his apprenticeship he painted miniatures, though in what manner his taste first showed itself is not exactly known; but it is asserted that it certainly was altogether spontaneous, without lesson or example, and was developed before he ever saw a picture. These works were executed in such a manner as to attract notice. His master took him to see the pictures of David Martin, which made so great an impression on Raeburn, then only about sixteen or seventeen years of age, that he redoubled his exertion. He continued to paint miniatures, which were soon in general demand, and as his time was thus fully occupied, completing (as he did) two in a week, his master agreed to allow him to withdraw from the trade, receiving as an equivalent part of the young painter's earnings.

Obtaining some of Martin's pictures to copy, he adopted oil-painting and after a time wholly abandoned miniatures. At the expiration of his apprenticeship, he became a portrait-painter, and gained very extensive practice. In 1779 he married, and some time after came to London, where he was much noticed by Sir Joshua Reynolds, who advised him to visit Italy, a course which he accordingly pursued, and remained in Rome and other places in Italy two years, carefully studying the works of the great masters. In 1787 he returned and established himself in Edinburgh, where in a short time he became the chief portrait-painter. He was elected a member of the Royal Society of that city, of the Imperial Academy of Florence, and of the South Carolina and New York academies. On the 2nd of November, 1812, or, as stated by some, in 1814, the Royal Academy of London elected him an associate of their body, and on the 10th of February, 1815, he was made an academician. On the visit of George IV. to Scotland in 1822, Raeburn was knighted at Hopetown-house, and in the summer of the following year he was appointed portrait-painter to the king for Scotland, an honour which he did not long enjoy. He died on the 8th of July, 1823.

Amongst his chief portraits may be enumerated those of Lord Eldin, Sir Walter Scott, Dugald Stewart, Professor Playfair, James Watt, Francis Jeffrey, Henry Mackenzie, John Rennie, and Sir Francis Chantrey. His style was free and bold, his drawing critically correct, his colouring rich, deep, and harmonious, and the accessories, whether drapery, furniture, or landscape, always appropriate, and though carefully executed, were never made too distinct or allowed to become obtrusive. He had a peculiar power of rendering the head of his figure bold, prominent, and imposing The strict fidelity of his representations may in a great degree be attributed to his invariable custom of painting, whether the principal figure or the minutest accessory, from the person or the thing itself, never giving a single touch from memory or conjecture. It has been judiciously said that all who are conversant with the practice of the art must have observed how often the spirit which gave life and vigour to a first sketch has gradually evaporated as the picture advanced to its more finished state. To preserve this spirit, combined with the evanescent delicacies and blendings which nature on minute inspection exhibits, constitutes a perfection of art to which few have attained. If the works of Sir Henry Raeburn fail to exhibit this rare combination in that degree, to this distinction they will always have a just claim, that they possess a freedom, a vigour, and a spirit of effect, and convey an impression of grace, life, and reality which may be looked for in vain amidst thousands of pictures, both antient and modern, of more elaborate execution and of minuter finish.

(*Annual Biography and Obituary*, vol. viii.; Allan Cuningham's *Lives of Painters*.)

RAFFAELLE. [Raphael.]

RAFFLES, SIR THOMAS STAMFORD, the son of a captain in the West India trade, was born at sea, off Jamaica, July 5, 1781. His early education was imperfect, for he was taken from school at the age of 15, and placed as an assistant clerk in the India House. In this situation he showed so much talent and industry, that he attracted the notice of the directors, and in 1805 was appointed under-secretary to the new government formed by the East India Company at Pulo-Penang, or Prince of Wales' Island. Here he devoted his attention to the study of the Malay language, the vernacular dialect of almost all the Eastern islands, in which he made rapid progress, as well as in a knowledge of the productions of Penang and the adjoining country, and the manners of the inhabitants. These acquirements rendered him so useful to the government, that he was soon appointed chief secretary, an office which he filled with the greatest ability: intense application in an unhealthy climate however, soon brought on serious illness, which compelled him to go to Malacca, in 1808, for the recovery of his health.

During his stay at Malacca, Raffles had an opportunity of mixing with a great number of natives congregated there from all parts of the Archipelago, from China, Cochin-China, &c., with whom he freely associated. He thus obtained a very considerable knowledge of their customs, trade, and languages, which was afterwards of great value to him. In 1809 he published his first literary essay, 'On the Malay Nation,' by which he attracted the notice of Lord Minto, governor-general of India, who sent for him to Calcutta, and was anxious to place him in the government of the Moluccas. Other events however interfered with this intention, for Raffles so strongly represented to Lord Minto the advantages which would accrue to the English government from the reduction of the Dutch settlement of Java (Holland being at that time annexed to France), that an expedition was fitted out against Batavia, in 1811, which was attended with complete success, that place being speedily captured. Raffles offered such valuable assistance in the preliminary arrangements of this expedition and in the execution of it, that he was appointed 'Lieutenant-Governor of Java and its dependencies.' He was only thirty years of age when he undertook this responsible situation, which he held for five years, being recalled in 1816, shortly before the island was restored to the Dutch. In his administration he evinced great energy of character, and displayed an anxious desire to advance the welfare of the native population. He found it necessary to make great alterations in the economy of the government, and a complete revision of the judicial system of the colony. He likewise abolished the system of slavery in the island. The policy of some of his measures was considered doubtful by the authorities at home, and his youth made him an object of jealousy to some of his colleagues; a number of charges were consequently brought against him, which led to his recal. But the board of directors of the East India Company afterwards acknowledged that his measures were all undertaken from most benevolent and laudable motives. Raffles devoted a considerable portion of time to the investigation of the natural productions of Java, and during his residence there he made many excursions into the interior, and collected much geological and geographical information respecting the island, as well as many interesting facts concerning the numerous ruins and other antiquities, and the character of the different native tribes. He arranged and published the different materials which he had thus collected, on his return to England, in his 'History of Java,' which appeared in 1817, 2 vols. 4to.

In 1818 he was appointed lieutenant-governor of Fort Marlborough, the seat of the English government at Bencoolen, on the island of Sumatra, and again returned to India, having first received the honour of knighthood. He remained at Bencoolen six years, during which time he effected many improvements in the political constitution of the colony and in the condition of the inhabitants. He emancipated the slaves here, as he had done in Java, for which act he did not however escape censure. He established a British settlement at Singapore, which has proved an important commercial station, and founded a college there for the encouragement of Anglo-Chinese and Malay literature. Though distinguished by his administrative abilities, Sir Stamford Raffles owes his reputation chiefly to his researches into the natural productions of Sumatra, and particularly to his numerous zoological discoveries. During one of his journeys into the interior, accompanied by the enterprising and lamented Dr. Arnold, he discovered the gigantic parasitical plant (or rather flower) which has been called the *Rafflesia Arnoldii*. In 1820 he sent home a large collection of preserved animals, which are now in the museum of the London Zoological Society. A paper containing a description of them was read before the Linnean Society, and published in their 'Transactions.' The excitement of various official and scientific engagements in a pestilential country, together with many domestic afflictions (four out of his five children, and almost all his personal friends, dying from the effects of the climate), so completely destroyed his health, that he was obliged to resign his appointment and return to England in 1824. In February of that year he embarked with Lady Raffles on board the ship Fame, which took fire the same night, by the carelessness of the steward. The crew and passengers with difficulty saved themselves in the boats, and Sir Stamford was obliged to remain at Bencoolen till the following April. By this disastrous event he entirely lost the greatest part of the extensive collection which he had formed of animals and plants, as well as many volumes of manuscripts and drawings relative to the civil and natural history of nearly every island in the Malayan Archipelago; besides this, which might be considered as a public loss, his own pecuniary loss by the burning of the ship amounted to upwards of 20,000*l*.

After his return to England he founded the present Zoological Society, of which he was the first president. His health however never recovered the shock which it had sustained, and he died in 1826, before he had had time to arrange the numerous materials which he had collected in the East. He left several manuscripts behind him. (*Memoir by Lady Raffles*.)

RAFFLE'SIA is the name of a plant found in the hot damp jungle of Sumatra, growing parasitically on a kind of vine, and discovered by the late Sir T. S. Raffles, whose name it bears. It consists of a number of scales investing a fleshy calyx measuring a yard in diameter, and containing the organs of fructification within or beneath the rim of a huge fleshy central column.

This and some other plants related to it, which are equally parasitical, are regarded as intermediate between such imperfect plants as fungi and the class of Endogens; and constitute the class now called Rhizanths.

(Lindley's *Natural System of Botany*, cl. 2, p. 389; Blume's *Flora Javæ*; and *Linnean Transactions*, vol. xiii.)

RAGHUVANSA. [Calidasa.]

RAGMAN'S ROLL, the uncouth name of the collection of those instruments by which the nobility and gentry of Scotland were constrained to subscribe allegiance to Edward I. of England in 1296, and which were more particularly recorded in four large rolls of parchment, consisting of thirty-five pieces sewed together, kept in the Tower of London. These instruments are for the most part extant in the third volume of Prynne's 'Records,' from p. 648 to 665, and have been recently but more correctly printed, under the auspices of the Bannatyne Club,* at the expense of the Right Honourable William Adam and the Right Honourable Sir Samuel Shepherd. These records contain the largest and most authentic enumeration now extant of the nobility, barons, landholders, and burgesses, as well as of the clergy of Scotland, prior to the fourteenth century.

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* 'Instrumenta Publica, sive Processus super Fidelitatibus et Homagiis Scotorum Domino Regi Angliæ factis A.D. MCCXCI.—MCCXCVI.,' 4to., Edinb., 1834.

The original and proper meaning of the word *ragman* has given much trouble to our etymologists; from other instruments and records however it seems clear that in diplomatic language the term ragman imports an indenture or other legal deed executed under the seals of the parties; and consequently that its application to the Rolls here in question implies that they are the record of the separate ragmans, or sealed instruments of homage and fealty, executed by the people of Scotland.

The 'Encylopædia Britannica' and Rees's 'Cyclopædia' speak of Ragman's or Ragimund's Roll as a roll denominated from Ragimund, a papal legate in Scotland, who, calling before him all the people who held benefices in that kingdom, caused them, upon oath, to give in the value of their estates, according to which they were taxed in the court of Rome. But this derivation evidently rests on a misnomer. No legate of the name of Ragimund ever visited Scotland. The name of the legate referred to was Bagimund, and his visit to Scotland to form his taxation was in 1274. (Spotswood's *Hist.*, p. 46.) Fordun, lib. x., c. 36, p. 122, calls him Bajamondus.

At the end of the second volume of Nisbet's 'Heraldry,' fol., p. 1-46, Edinb., 1742, there is a collection of 'Historical and Critical Remarks on Prynne's History, so far as concerns the submission and fealty sworn by the generality of the Scots Nation to King Edward I. of England in 1292, 1296, 1297, &c., commonly called Ragman-Roll.'

Much is said upon the various etymologies of Ragman's Roll in Jamieson's 'Etymological Dictionary of the Scottish Language,' vol. ii., in *voce*.

RAGU'SA or RAU'GIA (Rhacusa, in Latin; Dubrounik, in Sclavonian), a town in the kingdom of Dalmatia, subject to Austria, but formerly an independent state. It is situated on the eastern coast of a peninsula of the coast of Dalmatia, formed by the gulf of Breno on the east and the gulf of Santa Croce or Ombla on the west. The territory of Ragusa, which forms one of the four circles into which Dalmatia is now divided, extends along the sea-coast for about 90 miles, from the western shore of the Gulf of Cattaro to the north-west extremity of the peninsula of Sabioncello opposite the island of Lesina, which belongs to the circle of Spalatro. The width of the territory of Ragusa bears no proportion to its length, extending only a few miles inland, where it borders on the Turkish sandjak of Hertsek, which is part of the pashalik of Bosnia. On the west the territory of Ragusa is separated from the coast of Dalmatia by a tongue of land called Klek, which belongs to Turkey. The territory of Ragusa is in fact the coastline of the Hertsek or Turkish Dalmatia, and consists of a narrow strip of land between the mountains and the sea, and a few valleys in the mountains; it includes also the long low peninsula of Sabioncello, and the island of Meleda, which is nearly 30 miles long and two or three broad, Lagosta, which is 18 miles in circumference, Shupan, 9 miles in circumference, Mezzo, 5 miles in circumference, and some smaller islands or rocks. The fine island of Corzola, or Curzola, which is now annexed to the circle of Ragusa, did not belong formerly to that state, but was part of the Venetian province of Dalmatia. [CURZOLA.]

The mountains which run along the coast of Ragusa are a continuation of the mountains of Montenero, which divide Albania from the Hertsek [MONTENERO], and they are generally destitute of trees. But some longitudinal valleys which lie within these mountains are very fertile, and abound with copious springs, though no river, properly speaking, crosses the territory of Ragusa. The principal valleys are—1, that of Canale, extending more than 20 miles in length from Ragusa Vecchia to the shores of the Gulf of Cattaro near Castelnuovo; 2, the valley of Giuncheto, farther inland than Mount Bargat, or Vergato, the mountain which overtops the town of Ragusa; and 3, Val di Breno, east of Ragusa, which is three miles long and about two miles wide. The two last valleys are planted with vines and fruit-trees, and contain pleasant country-houses of the wealthy Ragusans.

The capital, Ragusa, is situated in 42° 38′ N. lat. and 18° 8′ E. long., and is built partly at the foot and partly on the steep declivity of two hills: it is fortified with walls and ditches, and has a castle on the east, at the entrance of the harbour and another at the western end of the town. The streets are paved, but very narrow, except two: the houses, which are built of freestone, are generally large and commodious. The principal buildings are, the cathedral, which is a good structure, and the palace of the government, which is extensive, and has some fine halls and galleries. The town is well supplied with spring-water. Outside of the walls are numerous gardens and country-houses, with plantations of orange and other fruit trees, and handsome fountains. From Ragusa along the western coast as far as the creek of Ombla, a distance of about three miles, there is an almost continuous suburb. The sea is deep along the coasts, and abounds with fish. The surrounding country produces abundance of fruit and very good wine: the malmsey of Ragusa has a great reputation, and forms an article of export. Cattle and cheese are brought in from the neighbouring mountains. The country produces little corn and oil; what is wanted is imported by sea. The climate of Ragusa is temperate and healthy, and instances of great longevity are not uncommon. The population of Ragusa, which is said to have once amounted to 30,000 inhabitants (Razzi, *Storia di Raugia*, 1595), is now only about 6000. Its maritime trade, which, during the period of its independence, was very flourishing, owing to the acknowledged neutrality of its flag and the protection of the Ottoman Porte, which secured it against the Barbary pirates, was almost annihilated after the French occupation in 1806; but it has somewhat revived since the peace. The Ragusans are reckoned among the best sailors in the Mediterranean, and have a good character for honesty and steadiness. Ship-building, manufactures of soap, liqueurs, and tobacco, are the chief branches of industry. Two miles west of Ragusa is the fine harbour of Gravosa, with docks for ship-building, and fine country-houses and gardens. Timber is carried thither from the opposite coast of Monte Gargano in Italy. Ragusa is a bishop's see, and has a lyceum and other literary institutions. It has produced several learned men: among others the mathematician Boscovich; Father Kunich, long professor of classical literature at Rome; Giacomo Luccari, the historian of Ragusa; the learned Banduri, author of the 'Imperium Orientale,' in the Byzantine collection; Benedetto Stay; Dr. Stulli, a physician and naturalist; and Tommaso Chersa: the last three died in the present century. Father Cerva, a Dominican, wrote biographies of the writers who are natives of Ragusa. Filippo de' Quartigiani, a native of Lucca, but who lived at Ragusa about the middle of the fifteenth century, wrote a kind of statistics of Ragusa, which has remained inedited. The language of the country is a dialect of the Sclavonian, resembling that of the neighbouring province of Hertsek, but more refined: all the educated people speak Italian, which, together with Latin, are the literary languages of the country. Ragusa has always maintained an intimate connection with Italy. (*Notizie istorico-critiche sulle Antichità, Storia, e Letteratura dei Ragusei*, 2 vols., 8vo. Ragusa, 1803.)

A few miles east of Ragusa is Ragusa Vecchia, on or near the site of the antient Epidaurus in Illyria, a Roman colony mentioned by Hirtius (*De Bello Alexandrino*, c. 44). The other towns of the territory of Ragusa are, Slano, a small place about fifteen miles north-west of Ragusa, and Stagno, about ten miles farther in the same direction. The latter, which is strongly fortified, is on the isthmus leading to the peninsula of Sabioncello. The island of Meleda contains six villages. The population of the whole circle of Ragusa is reckoned at 41,000.

History of Ragusa.—Ragusium, or Rausium, seems to owe its origin to the fugitive inhabitants of Epidaurus in Illyria, which was destroyed by the Slavi in the sixth century of our æra. The name of Rausium is said by Constantine Porphyrogennetus (*De Administrando Imperio*, c. 29) to be derived from 'lau,' a rock; from which was made 'Lausæi,' 'living upon rocks,' for such was the original situation of Ragusa; hence by corruption Rausa or Raugia, and Rhacusa. In the seventh century the population of Ragusa was much increased by emigrants from Salona, from Ascrivium (new Cattaro), from Dulcigno, and other towns of Dalmatia and Albania, and the town of Ragusa was then enlarged and fortified. The people organised their municipal government, consisting of a general council, composed of the members of the principal families, from which council the members of the senate, or executive, were drawn by lot. The chief magistrate, or president of the senate, was styled count, and afterwards rector, and was renewed every year. They also sent for a learned man from Greece, and made him rector; and through him they concluded a treaty with the emperor of Constantinople. They also made a treaty with the Sclavonian prince of Narenta, their immediate neighbour. This alliance with the Narentines, who were then very powerful by sea, continued until the latter part of the tenth century, when the emperor Basilius II. induced the Ragusans to forsake the alliance of the Narentines, who about the same time were defeated at sea by Pietro Orseolo, doge of Venice; after which the power of the Narentines dwindled away. The Ragusans now applied themselves strenuously to agriculture, as well as to maritime trade: they built vessels, and became powerful by sea. Stephen, king of Dalmatia, gave them an increase of territory; and after his death, his widow Margaret, in consequence of some disturbances which broke out in her country, retired to Ragusa with her daughter, and became a nun. Bogoslav, king of Croatia, a relative of Margaret, came with an army to besiege Ragusa, but was obliged to retire after devastating the territory. The Saracens from Africa also devastated the Illyrian coast: they took Ascrivium, Risano, and other places, and attacked Ragusa; but the emperor of Constantinople having sent an armament into the Adriatic, the Saracens left that coast, and threw themselves upon the opposite shore of Italy, where a Ragusan squadron joined the Imperial fleet, and defeated the Saracens. The annals of Ragusa for several centuries after this event exhibit a succession of wars and treaties between the republic and the Sclavonian powers of Croatia, Servia, Bosnia, and Bulgaria, as well as with the emperors of Constantinople and the Norman kings of Sicily, throughout which the small community of Ragusa preserved its independence and extended its maritime trade. Unluckily the annals are obscure and confused, especially with regard to dates, as are all the records which we have of the various Sclavonian powers which succeeded each other from the seventh to the fourteenth century in the extensive regions between the Danube and the Adriatic. Ragusan galleys joined Robert Guiscard, the Norman conqueror of Sicily, against Alexius Comnenus in the expedition to Durazzo; but Manuel Comnenus, having detached the Ragusans from their Norman alliance, bestowed privileges on their merchants, made them citizens of Constantinople, and caused a certain number of young Ragusans to be educated at his expense. Nearly about the same time the Ragusans made a treaty of commerce with Ladislaus I., king of Hungary. They also enlarged their town by building up the slope of the mountain to the northward; and as a new influx of Sclavonian families came to settle among them, Sclavonian became the prevailing language, and the Roman (probably a corrupt Latin) became gradually disused. The town now assumed the name of Dubronnik, which was derived from that of the site which was newly built upon; for until then Ragusa had retained the Roman language and customs and name, being originally descended from the Roman colony of Epidaurus. (Luccari, *Ristretto degli Annali di Ragusa*, b. i.)

About the year 1260 Demeianus, of the family of Giuda, then one of the principal in Ragusa, having been rector for one year, succeeded, by his connections, wealth, and popularity, in being re-elected for the following year, at the expiration of which, being strong with the support of the lower orders and that of some of his fellow-patricians, he contrived to prevent the yearly meeting of the great council for the purpose of electing a new rector. He thus retained the supreme magistracy for another two years, when several of the patricians, growing impatient of his usurpation, assembled privately at the house of Pirro Benescia, Demeianus' son-in-law, and resolved to get rid of him. As they could not effect this by their own strength, they agreed to call in the Venetians. Benescia repaired to Venice under pretence of commercial business, and having had interviews with the principal Venetian senators, it was agreed that Demeianus should be driven away, but on the condition that Venice should in future appoint the rectors of Ragusa. The Venetians sent two galleys, ostensibly to convey ambassadors to Constantinople. On arriving at Ragusa, the ambassadors repaired to the residence of Demeianus, and after being entertained by him, they prevailed upon him to accompany them on board. As soon as Demeianus had entered the Venetian galley, he was seized and bound, and the galley set sail for Venice. Demeianus was so enraged at this treatment, that he killed himself by beating his head against the boards of his cabin. From that time till 1368, Ragusa had Venetian rectors, who held office for two years each, and were taken from among the first patrician families of Venice. Razzi gives a list of them. Ragusa however still continued to govern itself as an independent state, and to be administered according to its own laws.

About the year 1320 the Ragusans, in order to obtain freedom of trade with the territories of the Byzantine emperor, agreed to pay him a tribute of 500 ducats a year, in consequence of which the Ragusan traders were admitted into the ports of the empire on the same footing as native subjects. In 1333, Stephen, king of Bosnia, gave to Ragusa the almost uninhabited districts of Ponta and Stagno, in the peninsula of Sabioncello, and the Ragusans set about building a strong fortress at Stagno, which commands the isthmus, at the expense of 120,000 ducats. The lands were divided, three-fourths among the nobles and one-fourth among the citizens, and an officer, with the title of count, was appointed by Ragusa to govern the ceded district. In 1348 the great plague which ravaged Europe spread to Ragusa, where it carried off 173 nobles, 300 citizens, and about 7000 of the lower orders. On this occasion, King Stephen of Bosnia showed himself friendly to the Ragusans by giving them provisions and other assistance. About 1368, war having broken out between Venice and the king of Hungary, the Hungarians advanced as far as Mestre, and Venice was obliged to sue for peace, one of the conditions of which was that Ragusa should be restored to independence and should choose its own rectors. It was also determined that the rector should be renewed every six months. In gratitude for this, the Ragusans agreed to pay a tribute of 500 ducats yearly to the king of Hungary, to hoist his flag on their ramparts by the side of that of the republic. In the great war between Genoa and Venice (A.D. 1378-80), the Ragusans sided with Genoa, and some of their galleys were at the battle of Chioggia. After the defeat of the Genoese, Venice sent a squadron against Ragusa, which applied to the king of Bosnia for assistance, by whose means they repulsed the Venetians, after which peace was made between Venice and Ragusa. About the year 1397 a new race of formidable invaders, the Ottomans, under Sultan Bayazid, having defeated Sigismund of Hungary at the great battle of Nicopolis, overran part of Bosnia, and spread alarm as far as Ragusa. About 1414 the Ragusans purchased peace with the Ottomans by paying an annual tribute of 500 ducats, which was afterwards gradually raised as the Turks drew nearer to Ragusa. In 1433 the Ragusans introduced the manufactory of woollens from Florence, which became their principal branch of internal industry. They also constructed an aqueduct to carry the spring water from the valley of Giuncheto to their town, at an expense of 12,000 ducats.

In 1440, George Despotos of Servia, being defeated by Amurath II., took refuge at Ragusa with his family and treasures, and was there protected against the threats of Amurath, and afterwards furnished with the means of proceeding to Hungary, where he joined the brave Hunyades. About 1450 the Turks overran part of Dalmatia and Albania. Bosnia however remained free, and was still a bulwark to Ragusa on the land side. The Ragusans purchased from several Bosnian lords the district of Ragusa Vecchia and Canale, which constitutes the eastern part of their territory, and distributed the land among their citizens. But in 1463-4 Mahomet II. conquered Bosnia also, and the Turks became immediate neighbours of Ragusa, and have been ever since. About 1471 they ravaged the eastern district, Canale, but Ragusa obtained a respite by raising the tribute to 8000 ducats. Mahomet's son, Bayazid II., showed himself favourably disposed towards the Ragusans, who sent envoys to congratulate him on his accession to the throne, with large presents both for the Sultan and for the chief officers of state, and from that time the Ragusans continued to send yearly envoys to Constantinople to pay tribute and to maintain a good understanding with the Porte. During the long wars of the sixteenth century, between Sultan Solyman and his son Selim on one side, and Venice and Spain and other Christian powers on the other, the Ragusans found it a most arduous task to preserve their neutrality, as the fleets of the belligerents came repeatedly off their coasts, and landed and plundered the territory without scruple. They were charged by the pope, Venice, and the emperor, with favouring the Turks, and by the Turks with being partial to their enemies, and this because they endeavoured to keep on good terms with both, supplied their respective shipping with provisions, and gave shelter to the fugitives of both parties. Charles V. pressed several of their galleys into his service, and confiscated several of their merchant vessels. When the Venetians, the pope's admiral, and Andrea Doria joined their fleets in the Adriatic, in 1538, against Barbarossa, it was seriously debated among the leaders whether they should not begin by attacking Ragusa and bringing it into subjection to Charles V.; but Andrea Doria opposed this measure, saying that he had come to fight the infidels, and not his brother Christians. (Razzi, *Storia di Raugia*, who lived in the same century.) The expedition against Castelnuovo and Cattaro was then resolved upon. After the taking of Castelnuovo the Spanish garrison which was left there made incursions into the neighbouring territory of Ragusa, plundering the people, violating the women, carrying off the young girls, and committing every kind of atrocity.

Upon this the Ragusans sent a learned monk to pope Paul III. at Rome, to justify their conduct and explain to him their critical situation, being in the jaws, as it were, of the dreaded Ottomans, with a scanty and rocky territory which did not afford them the means of subsistence. At last the pope promised to protect Ragusa. By means of envoys and of presents to the various powers, and by maintaining a most prudent conduct, the Ragusans managed to steer their little bark safely through that most stormy period. Ferdinand I. of Austria, brother of Charles V., claimed the annual tribute from Ragusa in his quality of king of Hungary, but the senate answered, that Hungary having been conquered by the Porte, the tribute was now claimed by the Sultan, and from that time Ragusa ceased to pay tribute to Hungary.

Ragusa was a city of refuge; emigrants from all parts found hospitality there; Christians flying from the Ottomans: Florentine patriots emigrating after the fall of their republic, among others Soderini, the exiled Gonfalonière of Florence; Italians from every part, men of learning, found there a good reception, Ragusa being still a half Italian city. Tommaso Chersa of Ragusa has written a notice of all the distinguished Tuscans who had been in various epochs settled at Ragusa, bishops, professors, men of letters, statesmen, &c. (*Degli Illustri Toscani stati in diversi tempi a Ragusa*, Padova, 1828.)

Ragusa was a sort of neutral ground, a stepping-stone between Christendom and Turkey, and much intercourse and correspondence were carried on throught it, which could not always be carried on direct with Constantinople. Sultan Selim II. used to say that he received more correct information through the merchants of Ragusa concerning what took place among the Christians in the West than from all his pashas and sandjacks. Envoys to the Porte, from France, Venice, and other Christian countries embarked in the ports of Italy, and, after a short navigation across the Adriatic, landed at Ragusa, where they were hospitably received, and from thence proceeded by land to Constantinople.

During the seventeenth and eighteenth centuries, after a better understanding had been established between the Porte and the Christian powers, Ragusa continued to enjoy her independence and neutral security, paying the accustomed tribute to the Sultan, who however did not interfere in her internal concerns, and no Turkish soldier was allowed to step within its boundaries. The Sultan's protection was of importance to Ragusa, by securing its flag from the attacks of the Barbary pirates. In this respect the Ragusan merchant-ships had the advantage over those of most states in the Mediterranean, and they acted as carriers in that sea between the Levant and the ports of western Europe, and realised considerable profits, especially in times of war. Respectable Ragusan mercantile houses were established in many of the seaport towns of the Mediterranean. The republic maintained a small fleet of galleys and other armed vessels for the protection of its coasts and its trade. In 1667 Ragusa was afflicted by a dreadful earthquake, which ruined the greater part of the town, and which furnished the subject of an elegant Latin poem by Stay, a native of Ragusa.

The inhabitants were divided into three orders, gentiluomini or patricians, popolani or citizens, and plebeians or lower orders. The gentiluomini consisted, in Razzi's time (sixteenth century), of twenty-nine houses, which were all that remained of one hundred and thirty-two houses, of which the patrician order of Ragusa had once consisted. Razzi gives a list of these twenty-nine houses, some of which were from Epidaurus, some from Cattaro and other places in Dalmatia and Albania, and others from Italy These houses, most of which had branched out into several families, intermarried with one another only, or with noble families of other countries. In the second edition of Luccari's more recent work (*Ristretto degli Annali di Ragusa*, 1790) we find the houses increased to thirty-three. The men wore long cloaks, in the old Florentine fashion, and round caps after the Venetian fashion. The patricians had the government entirely in their hands; they were all members of the general council or legislature, which met on the 1st of December every year, and out of which the members of the senate or executive were chosen, and were renewed every year. The rector or chief magistrate was changed in latter times every month. The patricians did not follow any trade or profession, but lived either on their rents or on the interest of their capital, which they lent to traders, ship-owners, and manufacturers. The citizens were chiefly engaged either in maritime or in retail trade. There was a council called minor, consisting of eleven old councillors, five of whom formed a court for criminal matters, and the other six judged in civil suits. There was also a board called 'Consiglio dell' Arte della Lana,' which decided questions concerning the trade, and especially the woollen trade, which was the most important. A stipendiary guard, of one hundred Hungarian soldiers and a captain, was kept by the republic, besides which there was a guard of native militia. Razzi, a foreigner and a monk, says that the councillors generally administered justice strictly, especially in criminal matters, but that in civil suits they sometimes favoured those of their own order. Luccari, a Ragusan and a patrician, says nothing about this. Razzi chiefly complains of the forwardness and impertinence of the boys of the patrician order, who used to carry things with a high hand, and even beat the other boys in the streets, who did not dare to resent this treatment in public, but sometimes, he adds, when the latter met their assailants in bye places, they took full revenge, and nothing more was said about it. He also complains that the said boys, while attending sermon, especially during Lent, would make a great disturbance in church, 'but,' he adds feelingly, 'as they were mostly of patrician families we could not control them, and must bear it with patience.' It was a proverb at Ragusa, 'Dalle mosche di Zara, e dai putti di Raugia cara, libera nos, domine' (the Lord deliver us from the flies of Zara, and from the boys of our beloved Ragusa). But of the grown-up men he speaks with esteem, as steady, well behaved, just, and civil. The people in general were content and thriving. The gentlewomen dressed mostly in black, with white veils thrown over their heads and shoulders, which covered their faces: unmarried ladies seldom appeared in the streets. The women of the other classes dressed in various colours, and went about with their faces uncovered.

The Ragusans from the beginning of their republic have belonged to the Western or Roman church. They were not very tolerant of the Greeks of the Eastern church, whom they considered as schismatics; and they drove them away from the territories which they acquired at different times. Luccari gives a list of the archbishops of Ragusa. Ragusa is now only a bishop's see, and its bishop is suffragan to the archbishop of Zara.

Ragusa had remained an independent state for more than a thousand years; it had stood the attacks of numerous barbarians; it had warded off the insidious approach of its formidable Ottoman neighbours; it remained as an advanced post of European civilization on the borders of wild Bosnia and fierce Albania; its independence and its flag were respected by all the states of Europe. Coeval with Venice, it fell soon after that republic. The French Revolution and the wars resulting from it destroyed its independence, as well as that of all the old republics of Europe. In 1806, France and Russia were quarrelling about the possession of the important district of Cattaro, one of the spoils of Venice, which was ceded to France by the treaty of Presburg between Austria and France. The Russians however from Corfu had been beforehand, and had taken possession of Cattaro, with the connivance of the Austrian local authorities and with the assistance of the Montenegrins. The French troops from Dalmatia could not reach Cattaro without crossing the neutral territory of Ragusa. 'The want of faith displayed in the affair of Cattaro gave occasion to another violation of faith concerning Ragusa

The soldiers of Napoleon, unable to occupy Cattaro, took military possession of Ragusa, in May, 1806, without any shadow of right, except the pretence of defending it from the incursions of the Montenegrins.' (Botta, *Storia d'Italia*, b. xxii.) But it was precisely the French occupation of Ragusa that led the Montenegrins to overrun its territory. They besieged the French within the town. The unfortunate Ragusans, placed between the regular French troops within and the savage Montenegrins without, saw their country-houses and villages devastated, but the town was saved from the Montenegrins. The result of this was, that Napoleon, by a stroke of the pen, in 1808, abolished the republican government, and incorporated Ragusa with the province of Dalmatia, and he made Marmont titular duke of Ragusa and governor of the province. Thus ended the independence of Ragusa, in the same manner and nearly about the same time as that of Genoa, Venice, Lucca, Geneva, Hamburg, and the other free towns of Germany. On the fall of Napoleon in 1814, when the Austrians again occupied Dalmatia, they found Ragusa included in that province, and they kept it, and it has ever since formed part of the Austrian territories. A good map of Dalmatia, including the territory of Ragusa, was published at Vienna in 1810: 'Carte von Dalmatien und dem Gebieth von Ragusa,' by Max. de Traux.

RAGWORT is the vulgar name of a plant called Senecio Jacobæa, which is so called from the ragged appearance of the leaves. It is a mere weed of no beauty; but the name is often applied to *Senecio elegans*, a Cape annual with purple flowers, which was formerly a common ornament of gardens.

RAI. [PERSIA, p. 476.]

RAIKES, ROBERT. [SUNDAY SCHOOLS.]

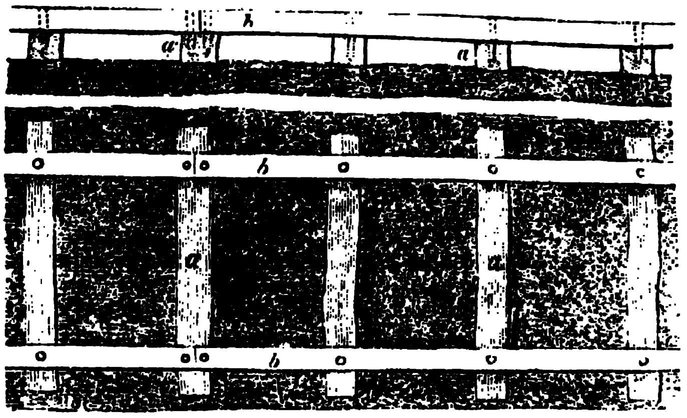
RAIL. (Ornithology.) [RALLIDÆ.]

RAILWAY, a road in which smooth tracks of wood, iron, or other suitable material are laid to facilitate the motion of wheel-carriages. Railways are of various kinds, and have been used for a very considerable time as a means of transport for minerals and heavy goods; and recently, in conjunction with locomotive steam-engines, have been introduced to a very important extent for the purposes of general conveyance.

As the construction of railway carriages and the power made use of for drawing or propelling them are subjects intimately connected with that of the formation of the road itself, it appears desirable to treat of the whole in one article. It is here intended therefore to present a sketch of the progress of inventions relating to railways; an account of the designing, executing, and mode of working a line intended for general traffic; and a condensed description of the principal railways completed or in progress in this and other countries.

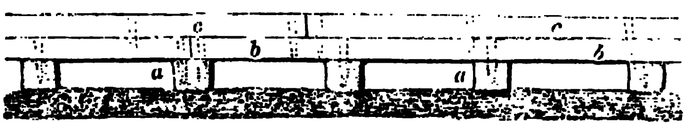
History.—Though some writers, in attempting to trace the origin of railways, have gone back to an earlier period, it does not appear that any satisfactory notice of what may fairly be considered as such is to be found before the seventeenth century, in the early half of which wooden rail, tram, or waggon ways were introduced in the collieries of the north of England. They were adopted in order to reduce the labour of drawing coals from the pits to the places of shipment in the neighbourhood of Newcastle-upon-Tyne, and they consisted, in the first instance, simply of pieces of wood imbedded in the ordinary road, in such a manner as to form wheel-tracks for the carts or waggons employed. The wooden tracks presented a much smoother surface for the wheels to roll upon than the very imperfect roads previously used, and therefore greatly increased the available power of the horses. The advantages even of this rude kind of railway were so great as to cause its extensive introduction in various mining districts, and in course of time several improvements were made upon it. About 1765, from a hundred to a hundred and fifty years after their first introduction, the wooden railways appear to have been made in the following manner:—The road was prepared by being levelled, or reduced to as uniform an inclination as circumstances would allow; pieces of wood, roughly squared, about six feet long and four to eight inches square, were then laid across it at a distance of about two or three feet from each other, and upon these other pieces, carefully sawn, about six or seven inches wide and five deep, were fastened by means of pegs, in such a manner as to form two wheel-tracks, about four feet apart. The road was then completed by filling the spaces between the cross-pieces (which are called *sleepers*), and under the rails, with ashes, gravel, or other road materials. *Fig.* 1 is an elevation and ground-plan of this primitive railway, *a a* being the sleepers, and *b b* the rails.

Fig. 1.



An important improvement on this construction consisted in the addition of a second set of rails, similar to the first, and spiked or pegged down to them, as shown in the elevation, *fig.* 2, in which *c* represents the upper rail. In the former plan the removal of a rail that was broken or worn out frequently occasioned the derangement of the sleepers, and rendered them useless, from the peg-holes becoming too large. By this improvement these inconveniences were removed, as the upper rails might be repeatedly renewed without disturbing the substructure, and there was no necessity for pegging twice into the same hole. Another advantage of the change was that, by the rail being raised, a greater depth of ballast or road material might be spread over the sleepers, to protect them from the horses' feet.

Fig. 2.

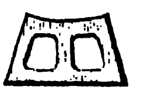


The vehicles used upon these wooden railways were generally waggons, containing from two to three tons of coal, mounted upon small wheels. The wheels were provided with a flange, or projecting rim, which, by coming in contact with the side of the rail, kept the waggon in the proper direction. Each waggon was drawn by one horse.

As it was desirable that, as far as possible, the power of the horses should be equally applied in every part of the road, it became usual at an early period, at least as early as 1716, to nail thin plates of malleable iron upon the surface of the wooden rails, wherever a steep ascent or a sharp curve rendered the draught harder than usual, so that the horse might travel with a full load upon the ordinary portions of the line, and yet, by the help of the greater smoothness of an iron surface, be able to pass the difficult points without inconvenience. The circumstances in which these lines were used were such that there was almost invariably a descent towards the river or sea-shore, which, being in favour of the load conveyed, was an advantage. Where the descent would otherwise be too abrupt, it was not unusual to make an elevated staith at the river end of the railway, and shoot the coal from the waggons, by an inclined plane, at once into the hold of the ships. Sometimes also, where the inclination would prove inconvenient if distributed equally along the line, it was so arranged that the greater part of the railway was made of a convenient descent, and the remaining fall accomplished by one or more inclined planes, or *runs*, which the waggons were allowed to descend by their own gravity, the velocity being checked by a piece of wood, called a *brake* or *convoy*, being pressed forcibly upon one or both of the wheels on one side of the waggon.

It may be supposed that the saving of labour effected by means of the wooden railway was considered sufficient for the purposes to which it was applied, as it continued in use for a century and a half without any important step being taken for the introduction of a more durable material. Some *stone-ways* were constructed for similar purposes, but, though possessing many advantages, they are not so smooth as those of wood. The next material improvement was the use of cast-iron plates upon the wooden rails. It is somewhat remarkable that, notwithstanding the well known effect of iron plates in diminishing the resistance, and their frequent use as already stated, this experiment is said to have been made more in consequence of accidental circumstances than as a premeditated measure of improvement. A wooden railway was in use at the Colebrook Dale iron-works, about the year 1767, when the price of iron became very low, and it was determined, in order to keep the furnaces at work, to cast bars which might be laid down upon the wooden rails, and save expense in their repairs, and which it was proposed to take up and sell as pigs in case of a sudden rise. This plan was suggested by Mr. Reynolds, whose name is also worthy of remembrance from the circumstance of his having erected the first iron bridge set up in England, also at Colebrook Dale. These bars, or 'scantlings of iron,' as they were called, were five feet long, four inches broad, and an inch and a quarter thick, and were cast with three holes for convenience of nailing to the wooden rails. Mr. Hornblower, an ingenious mechanician, known as a rival of Watt, in describing this road, remarks on the facility with which vehicles might be turned off the track when required, owing to the absence of a guiding flange; but this is a convenience incompatible with some of the most important qualities of a railway. Various plans have been proposed for combining the smoothness of a railway with the character of a common road, and of these perhaps none is more feasible than that patented by Mr. Woodhouse, in 1803, in which, by ingenious arrangements which it is not necessary here to detail, rails of the sectional form represented by *fig.* 3, are imbedded in an ordinary pavement or road. The concave form of the upper surface of the rail would tend to keep carriages in the right direction, and yet admit of their being turned out without difficulty. The ease of draught which would be attained by the adoption of such a plan may be conceived by observing the effect of the iron gutters in some of the streets of London, which closely resemble Woodhouse's rail in form, and are frequently made use of as wheel-tracks by drivers, notwithstanding the inconvenience, and even danger, arising from their being confined to one side of the vehicle.

Fig. 3.



Shortly after the experiment at Colebrook Dale, cast-iron rails with an upright flange, as shown in section in *fig.* 4, were brought into use. They were first used, it is believed, at the colliery of the Duke of Norfolk, near Sheffield, in 1776. Originally they were fixed upon cross sleepers of wood, like those used to support wooden rails. They were cast with holes for nails, and so laid down that the flanges should either both of them be towards the middle of the track, or *vice versâ*, so that, as explained by *fig.* 5, which represents an end section of the two rails fixed to a sleeper, with a pair of wheels on them, one flange on each rail is sufficient to prevent carriages running off.

Fig. 4.

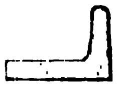
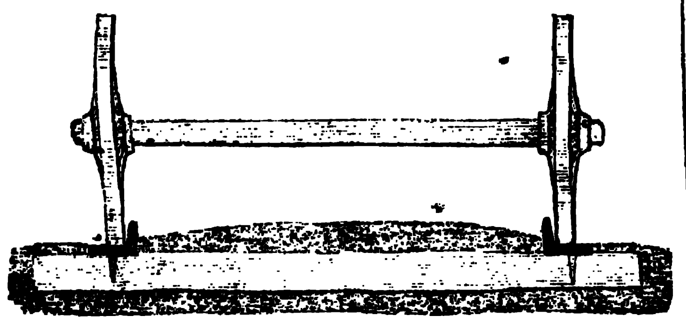


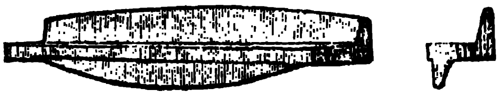
Fig. 5.



About the year 1793 blocks of stone were introduced as supports, instead of the wooden sleepers. They were, in the early railways, about a foot square, and eight or nine inches deep. One of these blocks is imbedded in the road under each joint in the rails, which are spiked down to wooden plugs inserted in the stone. As the foundation afforded by stone blocks is firmer than that of wooden sleepers, they were quickly introduced in most cases where a durable road was required.

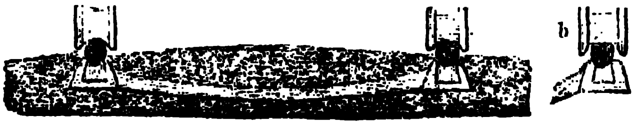
Many ingenious improvements have been made upon the kind of railway just described, which is still extensively used in mining districts for the conveyance of coal, ironstone, &c. It is, for distinction, called the *plate*-railway or *tramroad*, and is very convenient from the facility of its construction, and the circumstance that vehicles adapted for use upon it may also, if necessary, be used off the rails. The form of the rail is however a weak one, considering the quantity of iron used, and it is such as to permit the lodgement of stones and dirt, which not only impede the motion of the carriages, but are also liable to throw them out of the track. The former of these inconveniences has been in some degree remedied by the use of a rail with an under rib, as shown in *fig.* 6, a form which was adopted to reduce the cost of repairs on the Surrey tramroad.

Fig. 6.



The serious disadvantages of the plate-railway led to the use of *edge*-rails, which have now almost entirely superseded the previous form. The first edge-railway of any considerable extent was that completed in 1801 for the conveyance of slate from the quarries of Lord Penrhyn. Its construction is illustrated by *fig.* 7, which represents the two rails, and the form given to the tire of the wheels in order to keep them in the right course. These rails were of an oval section, the longest diameter being vertical. They were four feet six inches long, and had a dovetailed block cast beneath each end, which fitted into an iron sill imbedded in the road. The wheels were formed with a grooved tire, fitting loosely on the rail. It was found however that in course of time the groove became so deepened by wear as to fit the rail tightly, and thereby produce much friction. To remedy this, Mr. Wyatt, the inventor, introduced a rail and wheel formed as shown at *b*, *fig.* 7, in which the bearing surface of the rail and the corresponding part of the wheel were flat. The rails being laid only two feet apart, the carriages were necessarily small, and the friction considerable, yet the saving of power effected was such that two horses regularly drew a train of twenty-four waggons, each containing about a ton; and *ten* horses were found sufficient to conduct a traffic which had, on a common road, required *four hundred*.

Fig. 7.



The decided advantages of edge-rails were so well appreciated by the coal-owners of Northumberland and Durham, that they were adopted extensively by them within a few years after the successful experiment at Penrhyn. The form of rail most generally adopted was even better calculated to economise the strength of the iron than that of Mr. Wyatt. The following figures represent a mode of construction introduced early in the present century, and which is still used for colliery railways to a considerable extent. The rails are cast in lengths of three or four feet, and their greatest sectional dimension is in the depth. They are made of what is called a fish-bellied form, the lower edge being curved so as to give the rail greater depth in the centre than at the ends or points of support. *a*, *fig.* 8, represents the cross section of the rail in the middle, and *b* at the end. The ends are so made as to form a half-lap joint (*fig.* 9), and they fit into a suitable cavity in a cast-iron pedestal or chair, which is spiked down to the ordinary stone blocks or

Fig. 8.

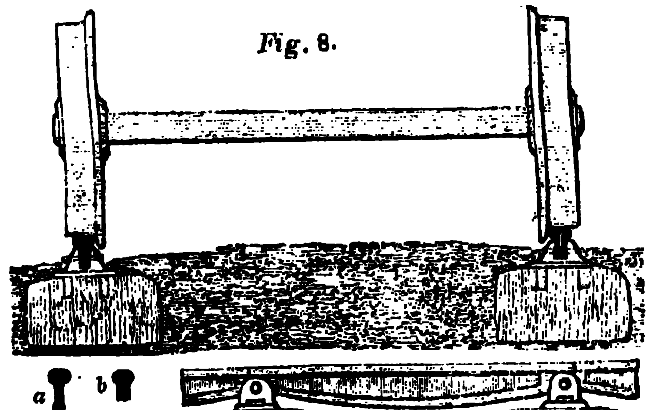
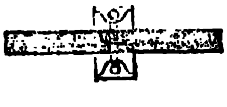


Fig. 9.



wooden sleepers. A side view of the rail with two chairs is given at *c*, *fig.* 8, and the upper part of the figure is a section of the railway as completed, showing also the form of wheel employed. It will be readily perceived that the rounded surface of the rail renders the lodgement of extraneous matter almost impossible. The means adopted to keep the carriages upon the rails are much the same in this as in the plate-railway, but the position of the parts is reversed, the protecting flange being upon the wheel instead of the rail. By this arrangement the flange may be made much smaller than that of a tram-plate, and the friction is usually still further diminished by giving a slightly conical form to the wheel-tires, so that the flanges are but rarely brought into actual contact with the rails.

Although the principle of construction here given is that most commonly followed, the details vary so much that hardly any two railways are alike. More will be said on this subject in treating of the improved railways constructed during the last ten years, it being the object here to present an outline of the progress made in the construction of railways prior to their recent extraordinary extension. The sectional forms of edge-rails, though very various, generally bear a considerable resemblance to that here represented; and the fish-bellied profile has been selected as the most usual, although *parallel* rails, or those with an equal depth throughout from end to end, have also been extensively used. The form of the chairs or pedestals, and the method of securing the rails to them, is also very variable. In *figs.* 8 and 9 the rails are represented as having half-lap joints, the two ends being placed together between the cheeks of the chair, and fastened by a pin driven through the whole. Sometimes the ends of the rails are made square, abutting against one another in the chair, and secured by a separate pin through each rail. Since the general introduction of locomotive engines, the use of pins has been abandoned, as they have a tendency to work loose, and wedges or keys, which may be tightened when necessary, have been applied in different ways in their stead. In some cases edge-rails have been cast with a pedestal attached to one end, fitted to receive the opposite end of the adjoining rail.

One other improvement in the construction of railways must be mentioned in this hasty sketch of their early history: it is the introduction of malleable iron as a material for rails, an improvement which may perhaps be considered to have done more than any other in preparing railroads for becoming the principal highways of a commercial country. From the commencement of the use of iron railways, much inconvenience was caused by the frequent breakage of the rails, especially those of the tram-plate form. The brittleness of cast-iron, owing to its crystalline structure, rendered it necessary that the rails should be made much stronger than sufficient to bear ordinary loads, that they might be able to resist accidental strains and shocks; but although many of the earlier railways were relaid with heavier rails than were originally supposed needful, breakages were of such common occurrence as to occasion much trouble and expense. So long as the travelling was restricted to a low rate of speed, the accidents and delays thus occasioned were of minor importance, but the difficulty of guarding against them would no doubt have greatly retarded the use of railways for the conveyance of passengers, had not an adequate remedy been provided before the experiment was made. Bars of malleable iron were laid down as rails to a limited extent as early as 1808, and there were some engineers who advocated their use, notwithstanding the inconvenience arising from their unsuitable form, no machinery being then used by which they could be made economically in any other than a square or flat form. The desire to introduce a more durable rail led also to experiments on the combination of wrought and cast iron; but these and all similar contrivances were superseded in 1820 by Mr. Birkenshaw's invention of an efficient and cheap method of rolling iron bars suitable for rails and other purposes. [IRON, vol. xiii., p. 34.] The fibrous texture of wrought-iron makes it far less likely to break when subjected to concussion than cast-iron, and the sectional form used is such as to render bending improbable. It is a remarkable fact that malleable rails, when in use, do not rust to any material extent, while the same rails, if lying on the ground beside the track, rapidly exfoliate and waste away. One very important advantage of malleable rails is the reduction that they effect in the number of joints, they being usually made fifteen feet long, while the brittleness of cast rails rendered it unsafe to have them more than three or four feet, the space between two points of support. Originally the long wrought rails were confined to the parallel form, but they are now, by a very ingenious adaptation of rolling-machinery, made fish-bellied when that form is preferred.

The application of railways having been, down to a recent period, limited to the conveyance of minerals and merchandise, and that at a very moderate velocity, there was little that requires remark in the construction of the carriages employed upon them. They were usually four-wheeled waggons, of small dimensions compared with those used on ordinary roads, in order that the weight might be distributed over a considerable length of road. Being guided in the required direction by the flanges, it is unnecessary to attach the axles of railway carriages in such a manner as to enable them to turn, and the wheels to lock under the body, as in common vehicles; and for the same reason, combined with the greater straightness of a railway, it is unnecessary, and mostly deemed unadviseable, to allow the wheels to revolve independently of the axles. The most approved plan, especially for edge-railways, is to fix the wheels firmly to the axle, and allow the axle to revolve in bearings attached to the body of the carriage. The wheels are almost invariably made of iron, those for slow traffic being cast, and others either wholly or partially made of malleable iron, in order to diminish the risk of fracture. Cast-iron wheels were found to wear very rapidly when used upon wrought edge-rails, but the application of the case-hardening process has rendered them more durable. From a very early period, railway vehicles have been fitted with an apparatus called a *brake*, consisting of a piece of wood adapted to the form of the wheel-tires, and capable of being pressed against them by levers or screws with sufficient force to impede or arrest their revolution, and consequently the progress of the carriage. Previous to the recent adaptation of railroads to rapid travelling, the use of springs was not common, either in carriages or locomotive engines.

In the infancy of railways animal power was the only means of locomotion employed to any considerable extent, but the purpose to which they were applied, that of conveying mineral produce to a place of shipment, naturally led to the application of gravity as an auxiliary, and, in some cases as the sole source of motion. Where, in such a case, the inclination of the ground is very moderate, the slope of the road is frequently so adjusted that no greater power is required to take a loaded carriage down, than to take it up again when empty. When a declivity occurs steeper than is convenient for the ordinary power, an ingenious arrangement called a *self-acting inclined plane* is occasionally resorted to, on which a loaded carriage, or train of carriages, is allowed to run down by the force of gravity, drawing a rope, which, after passing round a wheel at the top of the incline, is conducted down the slope and attached to an empty train—the force of the descent of the loaded vehicles being sufficient to cause the empty train to run up to the top of the plane. This admirable contrivance was introduced in the latter part of the last century, and is still extensively used. Stationary steam-engines, drawing the carriages by means of ropes guided by pulleys or sheaves in the centre of the track, have been used from an early period, generally in situations where the ascent is too great to be conveniently mounted by horse-power. Locomotive or moveable steam-engines, in many different forms, have also been tried at various times since about the year 1805, although for more than twenty years after that time their powers were very imperfectly developed.

In the following notice of the steps by which the locomotive engine has been brought to its present state of comparative perfection, those points only will be dwelt upon which are peculiar to that machine as applied to railroads, referring to STEAM-ENGINE for more general information, and to STEAM-CARRIAGE for a notice of its adaptation to ordinary roads.

The possibility of applying the steam-engine to the purposes of locomotion was conceived by several of its earliest improvers, and in 1784 a plan was suggested in one of the patents of Watt; but it does not appear that either he or any other inventor carried their ideas into practice until about 1802, when Messrs. Trevithick and Vivian patented a high-pressure engine which, by its simplicity and compactness, was admirably adapted for locomotive purposes. Within a few years they built several carriages, one of which, at least, was for use on a common road. In 1805 they made some interesting experiments with a machine similar to that represented by the annexed cuts, on a tramway near Merthyr Tydvil, and thereby proved the practicability of their plan. It is remarkable that notwithstanding the extreme simplicity of this machine, it possessed almost all the essential arrangements of the modern engines; and the ideas of its inventors were so complete, that subsequent engineers have had little to do beyond improving and carrying into effect the suggestions of their specification.

Fig. 10.

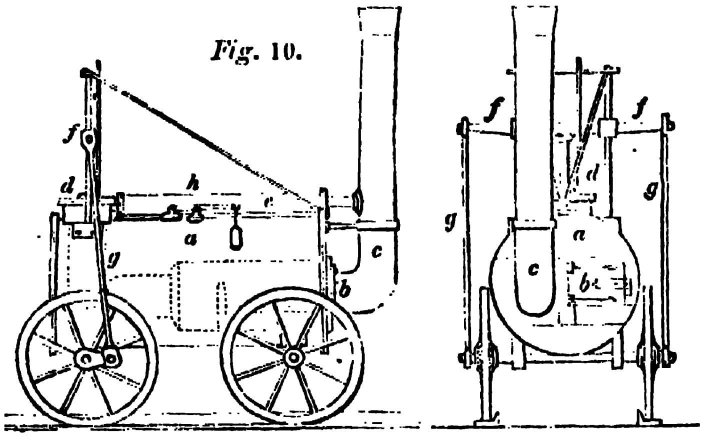


Fig. 10 is a side and end elevation of this machine, the same letters in each referring to the same parts: *a* is the boiler, which is of a cylindrical form with flat ends. The fire is contained in a large tube within, and on one side of, the boiler. One end of this is seen at *b*, and the form is indicated by dotted lines in the side view. This tube extends nearly to the opposite end of the boiler, and then, being diminished in size, it is turned round and brought out to the chimney at *c*. The fire-tube is completely surrounded by the water, by which arrangement steam is generated with great rapidity and of a high degree of elasticity. The steam-cylinder is placed vertically at *d*, being immersed nearly to the bottom of the boiler, as shown by the dotted lines. The steam is admitted alternately above and below the piston by means of a fourway-cock in a valve-box at the top of the cylinder, and the waste steam, after propelling the piston, passes by the eduction-pipe *e* into the chimney, where its emission causes a strong draft. The upper end of the piston-rod is attached to a crosshead *f*, which slides up and down on vertical guides, and from the ends of which connecting rods *g g* descend to cranks fixed on the axles of the fore-wheels, which are thus caused to revolve like the fly-wheel of a stationary engine: *h* is a safety-valve on the upper part of the boiler. The immersion of the working cylinder in the boiler is happily contrived for compactness and economy of heat, and has been frequently imitated in subsequent engines; and the admirable arrangement of throwing the waste steam into the chimney has been almost invariably followed, as it affords a blast always proportionate to the speed of the engine, and the consequent demand for the evolution of steam. This machine, when tried on the Merthyr tramway in 1805, drew a train of waggons containing ten tons of iron and a considerable number of persons at the rate of five miles per hour. Some inconvenience arose from the use of a single cylinder, because, although the impetus caused the wheels to revolve past the dead points of the crank, the motion was not regular throughout the whole revolution. A supplementary carriage followed the engine to carry a supply of fuel and water, and a small force-pump, worked by the machine itself, maintained the requisite quantity of water in the boiler.

Trevithick was aware that, although the adhesion between the engine-wheels and the rails was sufficient to ensure the progressive motion of his machine on a level or nearly level road, the wheels would slip round without advancing if the inclination were considerable or the load attached too great. He therefore in his patent proposed to remedy this by making the propelling wheels uneven by the projecting heads of bolts, cross-grooves, or fittings to railroads, where the adhesion of the plain wheels should prove insufficient. Being otherwise occupied himself, he did not proceed with his locomotive experiments, but many others entered the field, though they produced few useful contrivances that were not either used or suggested by him. An erro- [illegible] for many years generally entertained, that the adhesion of plain wheels was insufficient for any practical purpose, and consequently much ingenuity was expended in contrivances for securing progressive motion by other means. One of the most successful of these experimentalists was Mr. Blenkinsop, who, in 1811, patented a locomotive engine in which the power was applied to a large cogged wheel, the teeth of which entered a rack laid down beside the ordinary rails. Blenkinsop's engine was in other respects very similar to that of Trevithick, but two cylinders and pistons were employed, working separate cranks at an angle of 90°, so that one was exerting its full force while the other passed its dead points. Engines on Mr. Blenkinsop's plan were worked for some years on a colliery line near Leeds, and drew very heavy loads at a slow rate; but the friction of the machinery was excessive, and they are consequently now disused. In 1812 Messrs. Chapman constructed engines on eight wheels, all of which were turned by the machinery in order to increase the adhesion. They also proposed to stretch a chain or rope along the railway, which should pass round a grooved wheel turned by the engine, and thereby aid the progressive motion. Shortly afterwards Mr. Brunton invented a locomotive machine, which was caused to advance by the alternate motion of two legs, thrust out from the hinder end of the engine. This singular contrivance was carried into effect, and the machine was found to have considerable power, but an accident caused the inventor to abandon it. Similar propellers have since been tried by Gordon and Gurney upon common roads.

In 1814 and 1815 engines were again tried with plain wheels, and, being found efficient, were used upon railways in the north of England. Several attempts have however been made since that time to introduce contrivances for increasing adhesion, to enable locomotive engines to ascend planes of greater inclination than they will do with smooth wheels alone.

Patents were taken out in 1816 and 1817, by George Stephenson, in connection with Messrs. Dodd and Losh under which several locomotives were constructed and brought into operation upon colliery railways near Newcastle-upon-Tyne. The boiler in these machines resembled that of Trevithick, but the fire-tube passed completely through, instead of being turned and brought out at the back. Two vertical cylinders were used, each working a distinct axle and pair of wheels, the cranks of which were kept at the requisite angle of 90° by means of an endless chain stretched over grooved or toothed pulleys fixed on the axles; or, in the more recent engines, by connecting rods outside the wheels. A curious contrivance was introduced in them to protect the machinery from the effect of jolts caused by irregularities in the road. Four cylinders, open at the bottom to the atmosphere, and communicating at the top with the boiler, were attached to its under side, and pistons, working steam-tight in these cylinders, were fastened to the axle-bearings. By this means the pressure of the steam and water on the pistons caused the boiler and machinery to rise above the axles, and relieved them from concussions affecting the wheels. This plan ensured an equal weight bearing on each wheel, although the rails might not be level, but it has been abandoned, and steel springs employed instead. Engines of this kind seldom exceeded a speed of about five miles per hour, unless unloaded, when they occasionally ran at the rate of ten or twelve.

When the projectors of the Liverpool and Manchester railway were engaged in the design and execution of that great work in 1825 and the following years, the advantages of locomotive steam-engines were so imperfectly developed, that it was uncertain whether or not they should be adopted. The experiment of forming a railway for passengers as well as general merchandise traffic, had scarcely been tried, although the Stockton and Darlington railway, which was opened in 1825, had done more than any of its predecessors in showing the capabilities of a railway for such a use. As the Liverpool line approached completion, the directors took great pains to ascertain the best method of working it. They were soon convinced that horse-power was ineligible, as it was intended to aim at considerable velocity, and the expense of animal power when applied at a speed of eight or ten miles per hour, is very great. It was not so easy to decide on the comparative merits of stationary and locomotive engines. Various suggestions were made for the application of fixed engines at intervals of a mile or two along the line to draw trains by ropes from station to station; but it was eventually determined to use locomotives, and to offer a premium of 500*l.* for the best to be produced which would fulfil certain conditions, of which some were that it should not emit smoke, should draw three times its own weight at the rate of ten miles per hour, should be supported on springs, not exceed six tons weight, or four tons and a half if on only four wheels, and should not cost more than 550*l.* The trial was fixed for October, 1829, when four steam locomotives were produced, one of which was withdrawn at the commencement of the experiment. Of the other three, the Novelty, by Messrs. Braithwaite and Ericson, was materially different from any previously used, being very light, and having the requisite draft produced by a blowing-machine. Its performance was very promising, until an accident with the boiler put an end to the experiment. More recent attempts have been made to introduce engines of similar construction, but they have not proved successful. The Sans Pareil, by Mr. Hackworth, was very similar to Trevithick's engine, but had two cylinders, both working the same axle. The two pair of wheels were coupled together by connecting rods, so as to make use of the adhesion of them all. This engine attained a velocity of fifteen miles per hour with a gross load of nineteen tons, but at length gave way owing to a trifling accident. The remaining engine, the Rocket, was constructed by Robert Stephenson and Mr. Booth, of the Liverpool and Manchester railway, and succeeded in performing more than was stipulated for.

The following engraving represents a side view of the machine, with a cross section of a portion of the furnace: *a* is a cylindrical boiler with flat ends; *b* the fire-box, which is double, as indicated by the cross section, the fire being contained in the inner part, and the space of about three inches between the inner and outer casing being filled with water. Twenty-five copper tubes of three inches diameter extend longitudinally through the boiler, opening at one end into the fire-box, and at the other into the bottom of the chimney at *c*: *d* is one of the steam-cylinders, of which there were two, placed diagonally on the sides of the boiler. The piston-rods worked in guides, and by means of connecting rods transferred the motion of the pistons in a very simple and effective manner to the large wheels. It was arranged as usual that one piston was in the middle of its stroke while the other was at the end of the cylinder and consequently powerless. The waste steam passed from the cylinders along the pipe *e* to the chimney, in order to produce draft. *f f* are pipes connecting the water in the casing of the fire-box with that in the boiler.

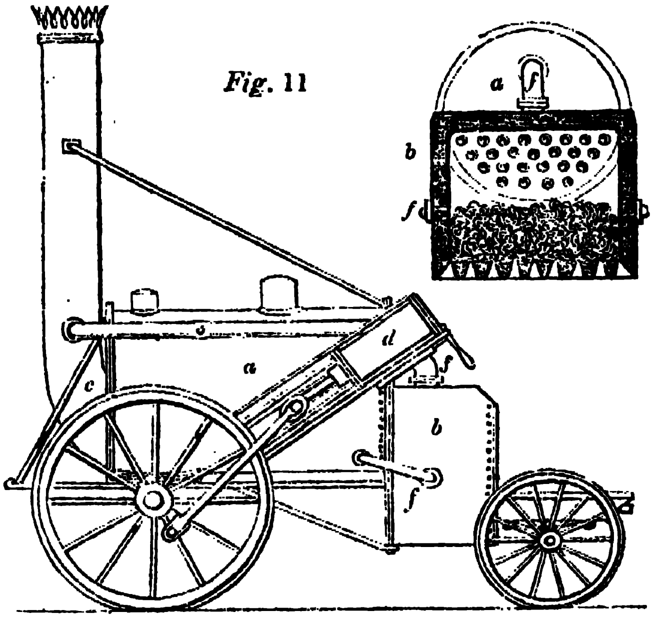


Fig. 11

The use of several tubes of small diameter instead of one large flue through the boiler, is the most important peculiarity of this machine, as, owing to the great extent of surface of heated metal thus placed in contact with the water, steam was produced with extraordinary rapidity. This plan, which was suggested by Mr. Booth, has since been carried to a great extent, by reducing the diameter and increasing the number of the tubes. The inclined position of the steam-cylinders caused the motion of the machinery to interfere less with the play of the springs than if they were placed vertically, but their situation had the disadvantage of exposing them to the cold air, by which the power of the steam is diminished, an inconvenience avoided in most subsequent engines by placing them horizontally in a casing under the chimney. The nuisance of smoke was prevented by the employment of coke as fuel.

The Rocket, with a gross load of seventeen tons, averaged a speed of fourteen miles per hour; but under some circumstances it attained double that velocity. Subsequent engines built by Mr. Stephenson were of much greater power, but, imperfect as the early attempts were, they proved, notwithstanding the incredulity of many, and even of some scientific men, the possibility of obtaining, by locomotive engines upon improved railways, a speed of travelling far beyond anything that can be effected by horses. Of the importance of this improvement in the means of intercourse, it is impossible, after the lapse of only ten years, to form an adequate idea; but the fact that since it was brought into operation a sum exceeding 60,000,000*l.* has been devoted to the construction of railways in this kingdom alone, may indicate in some degree the extent of the changes which it has been the means of introducing.

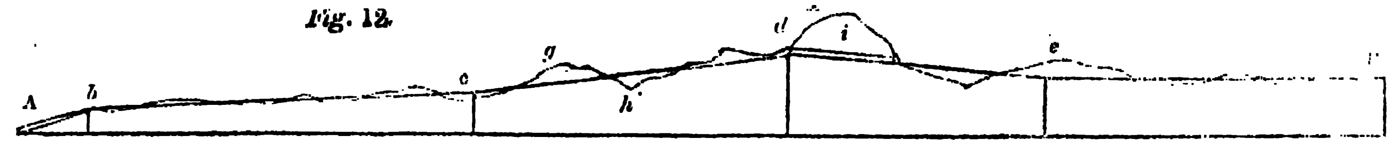
Having noticed the most important inventions and experiments connected with railways and locomotive machinery down to the time of their application on an extended scale upon the Liverpool and Manchester railway, it may be well to treat of subsequent improvements as they will come under notice in a sketch of the various operations of designing, constructing, and working a railway for general traffic.

Designing a Line of Railway.—It is not intended here to enter into a disquisition on the important economical questions which should be considered in marking out the main lines of communication in a country, and which, with some variations, are applicable alike to railways, ordinary roads, and canals. It is the opinion of many persons that a system of railroads should be laid out by the government of a country, whether they are actually formed by the state or by private individuals. Arguments in support of such a view have been drawn from the want of unity of plan which is evident in the railways of England, they having in most cases been designed in short lines from one important town to another, without due regard to combination of plan. The commissioners appointed to report on a system of railways for Ireland have considered this subject very ably, and endeavoured, in their proposed lines, to avoid the errors consequent on the limited views of private speculators. Most of the continental railways have been laid out more under government control than those of England, but there are not at present sufficient data from experience to allow of a fair comparison between the working of the two systems. In considering this point it should not be forgotten that, however desirable a comprehensive plan may be in a country yet to be supplied with railways, experience in cases most analogous leaves but little reason for supposing that the railway system would have made the sudden advances that it has, unless under the stimulating though by no means unexceptionable agency of private speculation and commercial enterprise.

When the termini and general course of a line of railway are determined on, there remain many points to be considered in selecting the precise direction which it shall take. It is necessary carefully to examine the country to be passed over,—its elevations and depressions—its rivers, canals, roads, and all other streams of water or means of communication that have to be crossed, or in any way interfered with—and its geological structure; any of which may occasionally render a deviation from the direct course adviseable.

It is evident that, as a general rule, a perfectly straight and level line is to be preferred, when the termini are of equal elevation; or a uniform slope when one is higher than the other. An attempt has indeed been made to prove that a railway formed in a series of undulations would be preferable to one perfectly level, because the power of gravity might be used to aid in the descents, and that of acquired momentum in the ascents, thereby reducing the amount of artificial power required for moving carriages upon the road. This theory excited much discussion a few years since, but the general opinion of engineers was not favourable to it. There are however some circumstances under which advantage may be taken of the powers of gravity and momentum, without the serious inconveniences which would attend the use of an undulating railway like that suggested by the author of this theory. But, desirable as a perfect level or uniform slope may be, it rarely happens that either can be attained for any great distance without involving such a deviation from the natural surface of the ground as would be very inconvenient. The engineer therefore so adjusts his inclinations or gradients as to make the nearest practicable approach to a level; avoiding if possible any loss of power from undulations of surface, by making all the inclinations on one side of the summit, or highest point to be passed over, rise towards it, and all on the opposite side descend from it. In order to the due adjustment of the gradients, a section or profile of the line of country is prepared, in which the elevations and depressions are drawn to a much larger scale than the horizontal distances, in order that, by being made disproportionately steep, they may be more readily recognised by the eye. *Fig.* 12 is a section of an imaginary line, resembling, except in its small size, those prepared for parliamentary inspection. The horizontal line at the bottom is given as a datum for measuring the elevations from, and is made to have reference to some fixed point near one of the termini. This section may be supposed to represent the line of a railway between a seaport town at A, and an inland town at F: the undulating line representing the natural surface of the ground; the straight lines from point to point, the intended surface of the railroad; and the vertical lines marking the changes of inclination. Owing to the intervening high ground, a uniform slope from A to F is impracticable, but a line with very moderate inclinations is obtained by tunnelling through the ridge at *i*, excavating the minor elevations, and filling up the hollows. If a road were made on the natural surface of the ground, a carriage passing along it would, after mounting to the elevation *g*, have to descend to *h*, and immediately remount to the top of *i*, thereby having twice to ascend an elevation equal to the difference between *g* and *h*, involving a considerable waste of power, which would be caused more or less by every undulation passed. But in a road constructed on the level of the proposed railway, not only would part of the elevation of *i* be avoided by the tunnel, but that which remains would have to be ascended but once, as every part between A and *d*, the summit of the road, rises towards it, though in different degrees; and in like manner the whole distance between *d* and *e* inclines downward, while the remaining part, from *e* to F, is perfectly level.

Fig. 12.



Owing to the short interval which has elapsed since the commencement of railway operations on a large scale, many theoretical points respecting them yet remain unsettled. Even the amount of retarding effect caused by passing over a given elevation is calculated variously by different engineers. On an ordinary road the resistance arising from friction and irregularity of surface is so great that the effect of gravity is scarcely perceptible on a moderate inclination; but on a railway the friction and road-resistance are reduced to so small an amount, that gravity, which remains the same, becomes a material part of the total resistance, even where the inclination of the road is so slight as to be almost imperceptible to the eye. A theory held by many engineers is, that an elevation of twenty feet requires an exertion of power equal to that on a mile of level railway; so that the same power which would move a given load over one mile of railway rising 1 in 264, or twenty feet in the whole, would move the same load over two miles of level road. The practical importance of this question is very great, because a correct understanding of it is essential to show how far it may be advisable to deviate from a direct course in order to avoid a given elevation. Supposing, for instance, that a railway is required between two points twenty miles apart, and that a straight course may be obtained by passing over an elevation of 100 feet, it may be preferable to increase the length to twenty-four miles, if by so doing a level can be obtained; because the elevation of 100 feet will require as great an expenditure of power as five miles of horizontal railway.

Another question on which there exists much difference of opinion, is the degree of steepness that may be allowed in any of the inclined planes without injuriously affecting the working expenses. It is often necessary to conduct a railway over a considerable elevation, but engineers differ as to the best arrangement of the unavoidable inclinations. Some prefer distributing the rise and fall as equally as possible throughout the whole line, while others consider it best to concentrate them in a few steep planes, in ascending which additional power is used, and making the rest of the line comparatively level. The Liverpool and Manchester railway may be cited as an instance of the latter mode, the main line having no gradient exceeding 1 in 849, with the exception of two inclined planes of about a mile and a half each, inclining 1 in 89 and 1 in 96, near Rainhill; at which it is usual to assist the trains by an additional locomotive engine. The Great Western railway also, in a length of 117¼ miles, has no steeper gradient than six feet six inches per mile, or about 1 in 812; but has two inclined planes of 1 in 100 for a length of one and a half and two and a half miles respectively. The London and Birmingham railway is an example of the former system, its ordinary gradient being 1 in 330, or sixteen feet per mile, which is nowhere exceeded except on the extension from Camden Town to Euston Square, which was intended for working by stationary engines. The characteristic or ordinary gradient on the Southampton, Brighton, South-Eastern, and many other lines, is 1 in 264, or twenty feet per mile.

A certain degree of similarity in the gradients is essential to the economical working of a railway by inanimate power which cannot be so conveniently urged as that of horses to a temporary exertion to overcome a short but steep ascent. If therefore any inclination occur so steep that the ordinary power cannot ascend it by a reduction of speed, it must either be surmounted by the aid of auxiliary power, or the engine must run over other parts of the road with less than a maximum load, and consequently at unnecessary expense. So long as this inconvenience is avoided, it is the opinion of some scientific men that the degree of inclination is of little consequence on a railway with an equal traffic in both directions, because the assistance of gravity in the descent being set against the additional resistance in ascending, brings the total amount of power required in traversing the line *in both directions* to nearly the same as would be needed were the road a perfect level.

Some highly interesting experiments have been recently made on this and other points of railway economy, under the superintendence of Dr. Lardner, of which the following seems to indicate that this compensating effect takes place on inclinations of much greater steepness than has been generally supposed. Great caution is necessary in forming calculations on such a subject from single experiments, however carefully conducted, but the results are certainly such as to justify serious inquiry. In July, 1839, the Hecla engine, with twelve carriages, making a gross weight, including the engine, of eighty tons, was run from Liverpool to Birmingham and back in the same day; by which means the same train, under as nearly as possible the same circumstances, had to ascend and descend every plane on the line, a length of about ninety-five miles. The time of passing each quarter-mile was carefully observed, so as to obtain the speed on every portion of the road. The following table, extracted from the seventh edition of Lardner on the Steam-Engine, gives the result of observations on gradients varying from level to 1 in 177, or nearly thirty feet per mile:—

Gradient. One in	Speed in ascending. Miles per hour.	Speed in descending. Miles per hour.	Mean speed. Miles per hour.
177	22·25	41·32	31·78
265	24·87	39·13	32·00
330	25·26	37·07	31·16
400	26·87	36·75	31·81
532	27·35	34·30	30·82
590	27·37	33·16	30·21
650	29·03	32·58	30·80
Level	——	——	30·93

From this table it appears that although the plane of 1 in 177 diminished the speed from near thirty-one miles per hour, the velocity on a level, to little more than twenty-two miles, in the ascent, the deficiency was fully compensated by the increased rapidity in the descent. The trifling difference in the mean speed on the different gradients may probably be attributed to accidental circumstances, but, small as it is, it is rather in favour of the steepest inclinations than otherwise. The result fairly indicates a most remarkable and valuable fact, namely, that a line of railway with gradients of from twenty to thirty feet per mile may be worked in both directions by the same expenditure of power as a dead level; and this fact, if substantiated by more extended experiment, proves that many millions may be saved in the execution of future railways by being content with steeper inclinations than have hitherto been admitted by most engineers to be adviseable. The whole of the compensating effect here produced is not to be attributed to the agency of gravity and momentum; a part, and perhaps a very considerable part of it, being due to the diminished resistance of the air to the passing of the train on ascents, owing to its reduced velocity. The nature and extent of atmospheric resistance to railway trains is a point on which so little is known, and opinions are so conflicting, that the extent of its influence in the experiment alluded to cannot be stated with certainty, but it is probably considerable, as the result is very different from that which might by calculation have been expected from the mere effect of gravity and friction. The resistance of the air being almost imperceptible in the case of common roads, owing to the great friction and moderate velocity, has frequently been considered too trifling to become an element in calculations on railway transit, and hence arises much of the error that has hitherto prevailed respecting inclined planes. For further information on this subject see **Resistance**.

Dr. Lardner thinks that his experiments indicate the gradient by which the gross resistance is doubled to be nearer 1 in 95 than 1 in 300, which he, in common with many others, had formerly considered the limit, though 1 in 264 has been mentioned above as being a more moderate and perhaps more usual calculation.

Curves on a main line of railway being, in consequence of the peculiar construction of the carriages and the speed at which they travel, very objectionable, a judicious engineer so adjusts his line as to avoid them when possible, and to make those which are inevitable of as large a radius as circumstances will admit. Curves of less than a mile radius are considered unadviseable for places where great velocity is required, although many of only half a mile radius are in use, the rails being so laid as to counteract the danger that might arise from the centrifugal force of trains passing over them, as explained hereafter. At stations and depôts, where the trains always move slowly, the radii may be much shorter without inconvenience.

It is essential to the public safety that a railway should not be allowed to cross any much frequented road on the same level. When the Liverpool and Manchester line was projected, as the rate of travelling was not expected to exceed ten miles per hour, no danger was anticipated from such intersections, which are called *surface-crossings*; and accordingly several were allowed; but their inconvenience and danger have caused some of them to be altered, the road being conducted under or over the railway by means of a bridge. In recent railway Acts it is enacted that no turnpike-road or highway shall be crossed on the same level; a rule to which exceptions are very rarely allowed; and if they are, gates must be erected to enclose the railway, and attendants stationed to open them when necessary for the passage of vehicles across it. These gates should be so hung as to completely close the railway when the road is open, and *vice versâ*. In a few instances two railways have been allowed to intersect each other on the same level, but this highly dangerous arrangement is now very rarely permitted. Where a single road is crossed, it may not be necessary to regard it much in selecting the level for the railway, as such road may be made to slope gradually to the requisite level for passing under or over it; but in approaching towns, where many communications are interfered with, it is essential that the railway level be made higher or lower than the ordinary surface, in order to avoid them. At Liverpool this is effected by tunnels under the town; at the London end of the Birmingham railway by an open cutting; and at Manchester, Birmingham, and many other places, by an embankment or viaduct. The Greenwich railway, extending over a metropolitan district the whole of its length, is entirely on a viaduct, and that from London to Blackwall, a similar line, principally so.

Railways, being usually constructed on as low a level as possible, frequently intersect the course of rivers and canals, rendering numerous and expensive bridges necessary. Where the course of the streams thus crossed is sinuous, expense may sometimes be reduced by making a new channel for the river, such a cut often being the means of avoiding the erection of two bridges, as in the instance of the Manchester and Leeds railway in the valley of the Calder.

Obtaining an Act of Parliament.—Railways being in this country constructed by associations of private individuals, with a view to their own pecuniary advantage, as well as to public convenience, it is necessary that, on the one hand, legislative restrictions should be imposed, to protect the interests of those who may, directly or indirectly, be affected by the formation of the railway; and, on the other, that the promoters of the scheme should be invested with considerable powers, to enable them to carry it into effect. Lands, buildings, rivers, canals, roads, &c. have to be intersected and otherwise interfered with; and while justice requires that no unnecessary injury should be inflicted on their owners, or the parties using them, and that every unavoidable interference should be amply paid for, it is also necessary to prevent a plan likely to be of great public benefit from being defeated by objections arising from prejudice or private interest.

Owing to the number of crude and ill-judged speculations of 1835, 6, and 7, which proved the necessity of imposing various restrictions on the facility of obtaining parliamentary powers, new standing orders were introduced with a hope of more effectually insuring the public against being misled by over-sanguine projectors. An opinion is entertained by many, that these regulations are now too stringent; and the very limited number of new undertakings sanctioned by parliament since they came into operation, though partly to be accounted for by other circumstances, leaves some reason to question whether, in the attempt to restrain improper speculation, legitimate enterprise has not been injuriously shackled.

Under the existing standing orders of parliament respecting railway bills, it is required that plans and sections of a proposed line, on a scale of four inches to a mile, shall be deposited with the clerks of the peace for the several counties through which it is proposed to carry the railway, on or before the first day of March, and in the Private Bill Office, &c., on or before the first day of April in the year preceding that in which an application is made to parliament for an Act. The plans are accompanied by a book of reference, showing the owner, lessee, and occupier of every house or piece of land liable to be passed through or otherwise interfered with. The sections indicate not only the length and inclination of each gradient, but also the actual elevation of numerous points above the base line used as a datum, and the elevation and proposed mode of crossing every stream or road intersected by the railway. Portions of these plans and books are also deposited for reference with the clerks of parishes through which the line runs, if in England, or if in Scotland or Ireland, with other specified officers; and notice is given of the intention to apply for an act of parliament, both publicly by London and county newspapers, and privately by notices to owners and occupiers of property affected. The former of these notices being given in February and March, a whole year is allowed for interested parties to consider the scheme and make preparations for advocating or opposing it in parliament. Before 1837, notices given and plans deposited in the month of November before the meeting of parliament, were considered sufficient. The shorter period was far more favourable to railway companies than the present, because the surveys are frequently made in the autumn, immediately after the removal of the crops, and the plans might then be prepared in time for obtaining an Act in the ensuing year; or, if a company were defeated in parliament one session, they might amend their line to obviate the objections brought against it, and be prepared for the next session. Now, a line surveyed in the autumn of 1840, must have the plans deposited in 1841, and the application must be made to parliament in 1842, so that it could scarcely be commenced till 1843; and a company failing in one session, must wait till the next but one, or proceed with plans deposited before a parliamentary opposition had shown what objections would be brought forward, or how they might be obviated. Owing to the long time between the plans being deposited and the Act being applied for, it frequently happens that they are deposited before a company is formed, with the intention of using them, if circumstances are favourable as the time approaches. The number thus provisionally deposited may be supposed from the fact that plans of thirty-six new lines were deposited for the session of 1840, none of which were brought forward. If the company intend to proceed with their project, the shareholders are required by the standing orders to subscribe to a contract, binding themselves, their heirs, executors, &c. to pay up the whole amount of the shares they take, when called upon to do so. This subscription contract must be signed between the time of making an application for an Act and the close of the session next preceding. They must also, according to the orders of the Commons, deposit a sum of ten per cent. on the proposed capital, in government securities. If the preliminaries have been duly attended to, a bill is brought in for incorporating the company and investing it with the necessary powers. After being read a second time, it is examined in a committee, which, if the bill be opposed, is composed of those members who represent the districts affected by the measure, and of a quorum, generally not less than three, of selected members having no interest in the question either personally or for their constituents. The committee report on the length, gradients, curves, and other peculiarities of the line; on the estimated outlay, and its apparent sufficiency; the traffic expected; the sufficiency or insufficiency of the existing means of communication for agricultural, commercial, manufacturing, or other purposes; and the probability of remuneration to the shareholders. They also receive lists of the owners, lessees, and occupiers of the land, &c. that may be required, showing whether they are assenting, dissenting, or neutral parties to the bill; and examine the list of shareholders, to guard against the introduction of irresponsible persons. Petitions presented respecting the bill are referred to the committee, who frequently insert clauses for the special protection of the petitioners. If there be any competing line of railway existing, in progress, or in contemplation; or if any parties oppose the bill on the ground of the line being unnecessary or injurious; a very expensive and tedious examination of witnesses is the result. Counsel are engaged on both sides, and evidence is heard sometimes on almost every point to be embraced in the report. The expense attending these contests is a strong argument against the existing system, which is considered defective also in many other points. After leaving the committee, the progress of a railway bill seldom excites much interest or attention. Unopposed bills are for the future to be re-referred only to the chairman of ways and means, and the two members in charge of the bill.

The preamble of a railway Act recites that it is expedient to construct the railway therein described, and that certain persons, whose names are given, are willing and desirous to make it at their own costs and charges. The Act forms them into a corporate body, invested with powers to take and make compensation for the necessary property, and to construct the railway. As the surveys are often made hastily and under great disadvantages, a deviation from the line laid down in the plan to the extent of a hundred yards is allowed for the sake of improving the line, such deviation being limited to ten yards in towns, and not being allowed to extend into any lands not included in the plan and book of reference. Powers are also given for altering, to a very limited extent, the levels and gradients defined on the parliamentary section. The company is allowed to raise a certain sum, sufficient to cover the estimated expense, in shares among themselves; and also, if necessary, to borrow a further sum, not exceeding one-third of their capital, as soon as one-half of it is paid up. Such additional sums may be raised in new shares, at the option of the company. Clauses are inserted to protect the rights of individuals, to [illegible]fy the dimensions of road, canal, and river bridges, and and gen. to be given to roads where they are altered. A pointed to co. [illegible]ctors, selected from the principal shareholders, for the capital fr[illegible] twelve to twenty-four in number, is ap- for a change as reque affairs of the company, to make calls loted out in this board, &c.; and provisions are inserted proprietors periodically, and by a certain number being balare given at their annual or the vacancies filled up by the to the company to half-yearly meetings. Powers make certain specified tolls, to carry passengers and goods, and for many other purposes. To provide for the possible abandonment of the scheme, it is stipulated that the compulsory powers for taking land shall cease after the lapse of two or three years, and that, if the works are not completed within a period of, in most instances, seven years, or, having been completed, are not used for three years, the land shall revert to the owners of adjoining property.

Owing to the numerous subjects embraced, a railway Act frequently fills from one to two hundred folio pages. It has been suggested that much expense and trouble might be saved by the passing of a General Railway Act, embracing those points common to all, so that an ordinary Act need contain only what is peculiar to the individual line. In many cases Amendment Acts are required by a railway company to enable them to raise additional money, or to execute extensions or alterations of the original line; but these do not require any detailed notice. As instances of the expense attendant on the present mode of obtaining railway Acts, when opposed, it may be stated that the London and Birmingham Railway Company spent more than 72,000*l.* in procuring theirs, and the Great Western upwards of 88,000*l.* The London and Brighton is perhaps the most expensive contest of the kind that has taken place, four or five companies having engaged in it for two successive sessions. When in committee, the expense of counsel and witnesses in the latter case is stated to have amounted to 1000*l.* daily, for about fifty days.

The act of parliament being obtained, the land required for the railway is definitely set out and purchased. Power is usually given to take a width of twenty-two yards, exclusive of what is necessary for the sloping sides of cuttings and embankments, but this width is seldom required. When moderate compensation is demanded for the land taken and the injury caused by the severance of estates, the removal of buildings, and other circumstances, the company have no need to put their compulsory powers in force. But where, as too often has been the case, exorbitant claims are made, recourse is had to a jury. In most cases where this alternative has been resorted to, the sum awarded has been much under that claimed,—frequently less than a quarter, and in one recent case only about a fiftieth part of it. The item of land is one of the causes of that excess of cost over estimates which has been so severely animadverted on, and another is the expense of extra bridges claimed by landowners as communications between severed lands, the trifling utility of which is indicated by the circumstance that, after extorting an agreement to build them, persons have often accepted one-half of their cost, in lieu of having them erected.

Formation of the Road.—Under this head is included the execution of those works necessary for the construction of a road (independent of the rails and finishing works), of the required level and width. These works consist of tunneling, excavation, embankment, and masonry for bridges, viaducts, and other erections. They are commonly divided into convenient portions, and let to contractors under agreement to complete them at a stipulated price and within a specified time. It is usual to commence those works which take the longest time first, that the capital expended on others may not lie idle till they are completed.

Tunnels are, in general, the most formidable works, and the time and expense of forming them can be least accurately calculated, because unforeseen circumstances often arise to retard their progress. Trials of the nature of the ground are made by boring, but these may indicate favourable strata, while, as in the well-known instance of the Kilsby tunnel, difficulties may exist requiring great energy and skill, and an enormous outlay to overcome. Being objectionable also on other accounts, tunnels are avoided as much as possible in the more recently designed railways. For the mode of constructing them, see TUNNEL.

Cuttings or excavations of great depth and extent are of frequent occurrence where the railway passes through high ground, but not at such a depth from the surface as to require a tunnel. The depth of cuttings is frequently from fifty to seventy feet and occasionally even greater. One very extensive excavation through the Cowran Hills, on the Newcastle and Carlisle railway, is as much as a hundred feet deep. The degree of slope necessary in the sides of cuttings varies greatly in different soils. Rock will stand when nearly vertical; chalk varies from nearly vertical to a slope of one horizontal to one vertical, or an angle of 45°;

gravel stands usually at one and a half to one; London clay from one to one to three to one, having in some instances stood at the former and slipped at the latter slope. Some materials are insecure at even a greater slope; blue soapy shale having, according to Lecount, slipped at an inclination of four horizontal to one perpendicular. The unexpected slipping of the slopes sometimes occasions much trouble and expense. A case lately occurred in the north of England in which a cutting to be formed in the side of a hill was estimated to require the removal of about 50,000 cubic yards of earth. It turned out, however, that the soft earth was held up by a seam of shale, which was no sooner cut through than a mass of earth slipped down into the line of the railway, of such magnitude as to require the removal of about 500,000 cubic yards. The great cutting at Blisworth, on the London and Birmingham railway, affords an example of a convenient and economical method of passing through earth in which strata of rock occur. The railway is at a depth of fifty or sixty feet, the upper portion of which is rock, and the lower consists of a less solid material. Instead of making an excavation of the slope required by the lower strata, which would have rendered the removal of the superincumbent rock indispensible, the sides were made nearly vertical, and the rock was supported by an under-setting of masonry. The great breadth of ground occupied by the slopes of cuttings, is a serious objection when they are in the vicinity of towns or pass through valuable property, in which cases the sides may be made nearly vertical, and supported by retaining walls, so curved as to enable them to sustain the pressure of the earth. The extension of the Birmingham railway to the Euston station affords a very bold and handsome example of this kind of work. In designing the works of a railway, the amount of excavation and embankment should be balanced as nearly as possible, so as to avoid the necessity of depositing earth from cuttings in spoil-banks, or having to purchase additional land to supply material for the embankments. Attention to this point will sometimes decide which is most expedient, a short tunnel or an open cutting.

Embankments are the artificial ridges of earth formed to support the railway on a higher level than the natural surface of the ground. Their dimensions are often fully commensurate with those of cuttings, from which their materials are mostly procured. In the ordinary mode of proceeding, an embankment is formed simultaneously with a cutting, the earth-waggons proceeding filled from the excavation along a temporary railway to the embankment, where they are tipped up to discharge their contents. A heavy embankment often forms the key, as it were, to the time of completing a railway. Tunnelling and excavation may be proceeded with at many different points, but an embankment, under ordinary circumstances, can be carried on only at the ends, and the number of men employed there is restricted by the limited space. Time is occasionally saved by the erection of a temporary wooden stage at the end of the embankment, affording the means of tipping a greater number of waggons at one time than can be done without it. Where the excavations do not afford sufficient material, embankments are partially formed of earth dug from trenches along their sides, and thrown up into the centre. This is called side-cutting, and, being an expensive proceeding, should be resorted to as little as possible. An important element in the cost of embankments is the length of the *lead*, or distance to be traversed by the earth-waggons between the points of filling and emptying. The sides of embankments, like those of cuttings, require a considerable slope, especially when the material is of an unfavourable nature. The earth should be deposited in layers of two or three feet thick, slightly concave on the upper surface, and, if time permit, it is well to allow one layer to settle before another is spread over it. The subsidence of newly-made embankments is a source of great expense, and sometimes of danger. It is usual to lay the rails in such a manner as to diminish the risk of accident from this cause, and to travel slowly over parts where a tendency to slip is observable, especially in wet weather, yet casualties will sometimes occur until these great earthworks are thoroughly consolidated by time. Allowance should be made for subsidence by making the embankments rather higher than they are intended to be finally. Great difficulties are experienced in embanking across marshy or boggy soils, which frequently sink under the weight of the earth deposited, the ground bulging up at the sides in consequence. Judicious drainage may do much in such cases, and the insertion of a frame-work of timber to bind the earth together and thereby check the unequal settlement of the embankment, has been tried with apparent success by Mr. Braithwaite on the Eastern Counties railway. To prevent carriages which escape from the rails falling over the sides of an embankment, mounds of earth are sometimes raised along them. The embankments raised across Chat Moss on the line of the Liverpool and Manchester railway, and similar places have excited much interest. The difficulties arising from the yielding nature of the material are greatly obviated by drainage, as, when dry, the moss itself becomes a fit substance for embanking, and stands well at a slope of less than 45°. The railway is sustained on part of Chat Moss by a platform of timber and hurdles, covered with earth and broken stone, and floating, as it were, on the spongy substratum. A peculiar kind of embankment required in hilly districts and along coasts consists of a road on the side of a steep elevation, one side being supported by a sustaining or revêtement wall. An important work of this kind is being executed along the face of part of the Dover Cliffs, for the South-Eastern railway, in which the revêtement wall is exposed to the sea. Similar constructions have been introduced on the Dublin and Kingstown railway, where there is also a remarkable embankment across the strand at Blackrock, that, at high-water, has the appearance of a mole stretching into the sea, which is allowed to pass through it by culverts. On the Preston and Wyre railway is an extensive embankment in a similar situation, but, when completed, it is intended to exclude the sea. Though yet unfinished, carrriages are enabled to pass along by the rails being temporarily supported on piling. On the Stockton and Hartlepool line a sea embankment of clay has been recently completed, the side being puddled and formed into such a curve as to bear the dashing of the waves without injury. Retaining walls are occasionally used to diminish the space occupied by embankments, as before mentioned in the case of cuttings. The Dublin and Kingstown railway commences in this manner, arches being introduced at the intersection of streets and roads.

The earth-works on most of the great lines of railway in England are very extensive, in many cases averaging from 100,000 to 150,000 cubic yards per mile. On the London and Birmingham line alone the quantity of earth and stone removed was about 16,000,000 cubic yards, which, if formed into a belt three feet wide and one high, would more than encompass the earth at the equator! When completed, it is adviseable to sow the slopes of cuttings and embankments with grass-seed, as their appearance is thereby improved, while the roots give cohesion to the surface, and render it less likely to be affected by weather.

The amount of masonry and brickwork required in the various erections of a railway is very great. The lining of tunnels, where the ground penetrated is of such a nature as to require support, forms a peculiar kind of work. Arching of almost every kind is more or less required in viaducts, bridges, culverts, and drains; and simpler work in the retaining walls, station buildings, and other necessary erections. Viaducts of great magnitude are often executed for the purpose of crossing valleys at an elevation greater than could be conveniently obtained by embankment, and also for entering or passing through towns. They are usually of stone or brick, but sometimes of wood or iron. [VIADUCT.]

Bridges are required occasionally for crossing rivers, and very frequently at the intersection of roads, and as communications between severed property. From a statement by Lecount, in the 'Encyclopædia Britannica,' it appears that, taking the mean of nearly a hundred railways, the number of bridges averages about two and a quarter per mile. Besides ordinary arches of brick and stone, bridges consisting of cast-iron girders laid from one abutment to the other, and supporting a platform of flag-stones, iron plates, or planks of wood, are very common. When the railway itself passes over such a bridge, six ribs are used, the distances of which are so adjusted that four of them sustain the rails and the other two the parapets, leaving nothing necessary between the ribs or girders, except a flooring of iron plates. By this arrangement great strength is ensured, and the depth or thickness of the bridge is reduced to a minimum, no ballast or road material being necessary. Wooden bridges of similar character are occasionally used.

A remarkable circumstance in the appearance of railway works is the frequent occurrence of *skew*-bridges. They are introduced when the railway intersects any existing communication at an oblique angle. Such arches were built before the introduction of railways called them into general use, but as, in an ordinary road or a canal, a deviation from the straight line is of little consequence, it was seldom thought necessary to apply them, and was customary to build the arch of the ordinary form, on the square, and accommodate the direction of the road or canal to it by curved approaches. But as on a railway straightness is of great importance, it frequently becomes necessary, in crossing other roads, to adopt a skew-bridge, in which the communications over and under the bridge form unequal angles with each other. For an account of the construction of these ingenious works, see SKEW-BRIDGE.

When the various works described are completed, with the requisite drains and fences (which are highly important), the road is ready for receiving those finishing works which entitle it to the distinctive name of *railroad.* The level of the earth-works, when completed, is called the *formation-level*, and is usually about two feet below the intended surface of the rails. The width of this surface is about thirty feet, exclusive of the drains and fences, and it is made a few inches higher in the middle than at the sides, in order to throw off water.

Ballasting and Laying the Permanent Way.—In order to obtain a firm dry foundation for the blocks or sleepers to which the permanent rails (so called to distinguish them from the slight temporary tracks laid down during the progress of the work), are fastened, a layer or stratum of broken stone, technically called *ballast*, is spread over the road for a thickness of a foot or more, varying according to the construction adopted and other circumstances. After the rails are laid down, similar materials are used to fill in the spaces between the blocks and sleepers. The broken stone should be so small that any piece would pass through a ring two inches and a half diameter. Other substances are occasionally used, especially for the upper part of the ballast, as gravel, river-sand, and burnt clay. In some situations, with good ballast, no surface drains are necessary; but drains consisting of a brick channel along the middle of the line, with small cross drains at intervals towards each side alternately, are often required.

The great variety of opinions as to the best form and manner of fixing the rails, renders it impossible, in the limited space which can here be devoted to the subject, to do more than select a few examples of the plans principally used. The most important question involved in these differences is that of the intermediate or continuous support of the rails. The most common method of fixing them is to fit them into iron chairs, which are spiked down to blocks of stone imbedded in the ballasting. This plan, although it appears by experiment to afford the firmest foundation, has several disadvantages. The points of support, being isolated from one another, are liable to be deranged by any subsidence in the ground, as well as by the constant vibration consequent upon the rapid passage of heavy trains, and the small but irresistibly powerful action of temperature in causing the expansion and contraction of the rails.

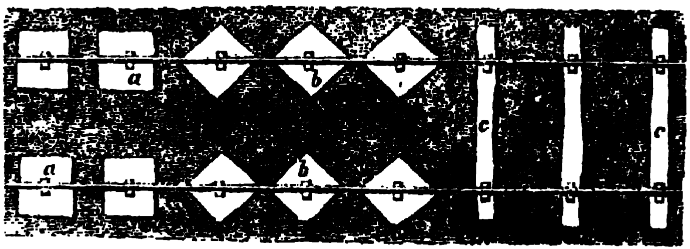
The former of these inconveniences is in some degree obviated by substituting cross sleepers of wood (like those described as being used in the early railways), for the stone blocks upon such parts of the line as are likely to sink. The two rails being, in this case, attached to the same sleeper, are not liable to be thrown out of gauge, or, in other words, to lose their parallelism, although the unequal sinking of the sleeper may cause one rail to become lower than the other. This application of wooden supports has been in most cases considered a temporary one, it being intended to lay stone blocks in their stead so soon as the ground became sufficiently firm; but as it appears from experience, both in this country and in America (where, owing to the abundance of timber and the high price of labour, wood has been much more extensively applied to railways than in this country), that the motion of carriages on those parts of a line supported by wood is smoother and quieter than on others, some engineers consider that the plan of construction upon cross-sleepers is preferable to that upon stone blocks.

In both of these modes of supporting the rail, it is sustained only at intervals of three or four feet, the intervening portion acting as a bridge, which, though very rigid, yields in a slight degree when carriages, and particularly the heavy locomotive engines, pass over it. The surface of the rail is thus converted into a series of minute undulations, the effect of which is to increase the resistance. It has been thought that these undulations were of little consequence, the gain in descending being a counterbalance to the retardation of the ascent; but Professor Barlow, in reporting on experiments made by him in 1835, for the London and Birmingham Railway Company, expresses an opinion that 'the advantage of the descent is, owing to the velocity and the shortness of the inclined plane, scarcely appreciable, and that the result of the deflection will be equivalent to the carriage being carried up a plane of half the whole length, the other half being horizontal.'

These and some other considerations have led to the adoption of a continuous support to the rail, which has been effected in several different ways, and with various success. Intermediate supports, being the most extensively employed, will be first noticed, and stone blocks, according to general opinion, claim the precedence among them.

The blocks used upon recently constructed railways are about two feet square and one thick, though much smaller ones were considered sufficient before the use of locomotive engines became general. They are roughly squared, but have so much of the surface as is to receive the chair accurately flattened. The chairs are usually fastened down by two or three iron spikes, to receive which holes are made in the stone, and filled with wooden plugs. The plugs should always be bored to receive the spike, and driven tight into the stone, though they are sometimes put in loose and split by driving the spike. Spikes or pins of well dried oak have been used instead of iron spikes for securing the chairs, and have been found very durable, but are not generally approved for lines worked at great speed. The introduction of a piece of felt between the chair and the block is useful in deadening concussion. As it is highly important that stone blocks should be well bedded, it is usual to cause them to form a solid foundation for themselves by repeatedly falling from a small elevation on to the spot where they are to rest, sand or very fine gravel being thrown under them between the times of falling. For this purpose a portable machine with an elastic wooden lever about twenty feet long is used, the block, to which the chair has been previously attached, being suspended from the short end, and a man stationed at the opposite end to raise and drop it. When the stone has made a firm bed, and has dropped in the right position, which is determined by levels and sights, it is detached from the lever and surrounded by ballasting, care being taken not to disturb it at all. It is evident that this careful bedding would be thrown away on an embankment, or any part where the newness of the ground would render subsidence probable. *Fig.* 13 is a ground-plan illustrating the use of stone blocks and wooden sleepers. *a*, *a*, represent blocks laid square with the road and *b*, *b* the same laid diagonally, a position now generally preferred, being convenient in repairing the road when a block sinks, because workmen can get at every side for the purpose of ramming ballast under it. Blocks of Scotch asphalte have been tried in lieu of stone, but with what success the writer is not aware. A few were laid down on the Southampton railway, and the chairs were spiked down without boring the block. Other similar substances have been suggested in order to diminish expense. It has also been proposed to use cast-iron bed-plates instead of blocks, by which several important advantages were anticipated, but no such plan appears to have been brought extensively into use. In the Dublin and Kingstown railway an attempt was made to ensure increased solidity by introducing *throughgoing* stone blocks, which were formed of granite, six feet long, two wide and one thick, and stretched across the track. These were placed fifteen feet apart, ordinary single blocks being used between them, at intervals of three feet. Owing perhaps to the difficulty of bedding such large blocks, the plan did not answer, the motion over them being harsh and unpleasant, and the vibration such as to break many of the long blocks. In some cases, particularly

Fig. 13.



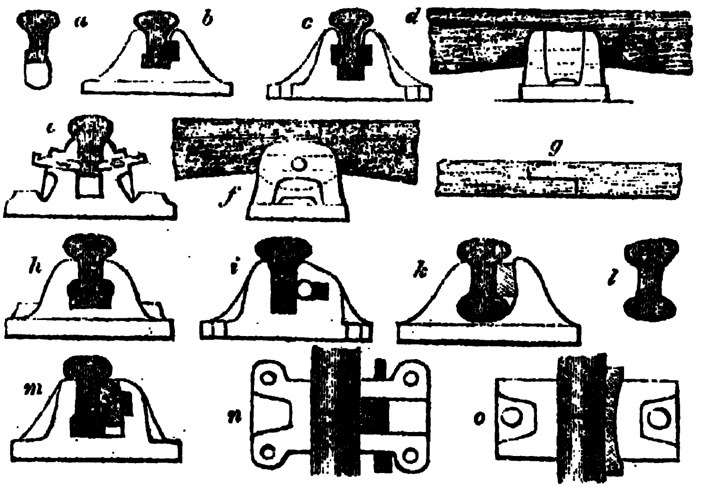
on sharp curves, iron tie-rods have been used to connect two opposite chairs, and counteract any tendency to separate which might arise in such situations from the isolation of the blocks.

The use of cross-sleepers, which are represented by *c c*, *Fig.* 13, needs little remark. They are mostly from seven to nine feet long, and consist sometimes of whole trunks of small size, and in other cases of half trunks laid with the flat or sawn side downwards. These and other timbers connected with a railway are now almost always Kyanized, and the durability imparted to them by that process is greatly in favour of their use as a permanent foundation. Several lines of railway have recently been laid entirely upon these sleepers.

The distance between the points of support varies from three to five feet. Bearings of greater length have been used, but on railways for locomotive engines have been found unsuitable, from their greater liability to get out of repair. Experience has not fully decided the comparative advantages of long bearings with heavy rails and blocks, and short ones with comparatively light supports; but a greater length than three feet nine inches or four feet has seldom proved successful. Owing to the deflection of the rails, Professor Barlow enforces the importance of placing the supports exactly opposite to each other, that both sides of a carriage may be equally affected.

Rails and Chairs.—Allusion has been made in a previous page to the difference between fish-bellied rails, or those with the under side curved so as to give increased depth in the centre of the bridge between two chairs, and those of a parallel form, which are of the same depth and section throughout. The experiments of Barlow and others leave it questionable whether any additional strength is obtained from a given weight of iron by the fish-bellied shape, and therefore parallel rails are now almost universally adopted. They possess this, among other advantages, that the length of bearing on the different sides of a curved track may be so varied as to keep the chairs opposite to one another, which cannot be done with fish-bellied rails. *Fig.* 14 represents some of the principal varieties of form and contrivances for fixing the rails, which have been introduced on English railways: *a* is a section of the fish-bellied rail originally used on the Liverpool and Manchester railway, the shaded part being that which enters the chair, and the outline indicating the increased depth in the centre.—*b* is the same rail, as fixed in the chair, the black part representing the end of an iron wedge or key, which is driven in to secure it. —*c* and *d* are a section and side view of a plan invented by Mr. Losh, and used on the Newcastle and Carlisle railway. The rails are made with a curved projection on the under side, to fit into a suitable concavity in the chair, as indicated by the dotted lines in *d*. Two iron keys are used, driven in opposite directions. Any contraction of the rail tends to draw it laterally out of the chair; but in doing so, the curved base rises in its seat and tightens the keys, which press downwards as well as sideways.—*e* and *f* are similar views of a method contrived by Robert Stephenson, and used on part of the London and Birmingham railway. In this the seat of the rail is flat, but bears upon a segmental piece of iron laid loose in a concavity in the chair, so that an irregularity which may cause the chair to tilt in the direction of the rail, may not affect its position. The rails are secured by cylindrical pins, the points of which enter depressions in the side of the rail. Each pin has a slit through it, which, when in its proper position, tallies with holes through the cheeks of the chair. Iron keys driven into these holes prevent the pin from moving, and, acting as wedges against the end of the slit, force the pin tight against the rail. The chair represented is a joint chair, and *g* shows the form of the joint, which is called a half-lap. The narrow part of the rail is not divided, but turned aside at the joint, as shown by the dotted lines. Intermediate chairs are similar, but have a pin on one side only. This mode of fixing allows the rail to slide a little in the chair, on account of expansion and contraction, and the keys are not so liable to work loose as when in contact with the rail. These are all for fish-bellied, and the following for parallel rails.—*h* is a rail and chair invented by Mr. Daglish, and rewarded by the London and Birmingham Railway Company, as presenting the best sectional form of rail. The chair is proposed to be fixed to the block or sleeper by bolts passed through from the under side, and keyed above the chair. The rail is fastened by two semicircular iron keys driven in opposite directions. This arrangement, though ingenious, has the disadvantage that the rail could not be taken up without removing the chair.—*i* is a contrivance in which an iron ball, dropped into a socket in the chair, is forced against the rail by a key driven through a hole in one cheek of the chair. It is simple, and affords sufficient lateral movement for the effect of temperature on the rail. This form of rail is known as the T rail.—*k* and *o* are a section and ground-plan of a chair in which the rail is held by a wooden key. The keys are well sea-oned, and when in use become by expansion almost immoveable; because, as shown in *o*, they are most compressed in the centre. So great indeed is the expansive force of the wood, that it occasionally breaks the chairs. This mode of construction is extensively used on the Grand Junction, Birmingham, Southampton, and other railways —*m* and *n* show another application of a wooden fastening, adopted by Mr. Storey on the Great North of England railway. A block of wood is so placed in the chair as to be prevented from moving endways, and is held to the rail by an iron wedge driven through the cheek of the chair.—*l* is a rail contrived with the idea of fitting the wheel more accurately than those of the ordinary shape, but it is not much used. The rails here represented vary much in strength; *a* and *b* were made about thirty-five pounds to the yard, but have been found too light, and replaced by parallel rails of sixty pounds; *e* and *f* are fifty-pound rails, for three feet bearings. Rails similar to *k* are made from sixty to seventy five pounds per yard or more, for bearings of three to five feet, and they are now seldom used of less weight than seventy pounds to the yard. The most common joints are square, as *n* and *o*, but half-lapped and scarfed or diagonal joints are also used. The concussion produced by a very slight irregularity at these points is so injurious, that probably increased care and expense in making them perfect would be well bestowed. Chairs are almost invariably made of cast-iron, as their complex form renders it difficult to manufacture them otherwise with sufficient economy; but as they are liable to breakage from their brittleness, it has been proposed to make them of malleable iron, and machinery for the purpose has been patented, but apparently not yet brought into operation.

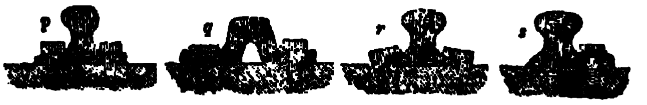
Fig. 14.



Railways on Continuous Bearings.—The introduction of this kind of railway is perhaps mainly to be attributed to the extensive use of timber in such works in America. It has not only been used in lieu of stone, but also in a great measure in the place of iron. In many of the American and some of the Continental railroads, beams of timber laid continuously, and firmly connected together by cross pieces, are made to supply the strength usually given to iron rails; the application of iron being limited to a flat bar or plate two inches and a half wide, and from half an inch to an inch thick, nailed to the beams on their inner edges for the wheels to roll upon. Though differing in details, this construction of railway is very like the oldest form used in this country, the wooden tramway. Frequently these beams or wooden rails are supported upon cross-sleepers; but whether they are so or not, their breadth of surface causes them to receive considerable support from the ballast or road materials, along their whole length. Mr. I. K. Brunel, engineer of the Great Western railway, was one of the first British engineers who proposed a similar construction, which he did with the hope of obtaining a smoother and more elastic road, which should at once be more agreeable to ride upon, cheaper to maintain, and safer for travelling at high velocities than a railway constructed in the ordinary manner.

Although some of the supposed advantages are at present questionable, the superior smoothness of motion on such a road, when in good order, is pretty generally admitted, and an opinion seems to be gaining ground that, though longitudinal timber bearings do not produce so firm and unyielding a railway as stone blocks, and may therefore require rather more power in working, this disadvantage is more than counterbalanced by the diminished wear and tear, of which the comparative absence of noise is a tolerably accurate criterion. The Great Western railway can hardly be compared with any other, on account of its increased width, but the London and Croydon, which is entirely, and the Manchester and Bolton, Hull and Selby, and several other lines, which are partially laid in this manner, and which in other respects resemble those of the more common construction, may be fairly brought into comparison with them. The Greenwich railway is a remarkable instance of the superior comfort of timber bearings to those of stone, the rigidity of the latter being aggravated by the circumstance of being on a viaduct. On this line, as has been the case on that from Dublin to Kingstown, it has been deemed advisable to remove the blocks, and substitute a more elastic structure of wood. The longitudinal timbers on the Croydon railway vary from nine to fourteen inches wide, and four and a half to seven inches deep; and cross-sleepers are bolted under them at intervals of three feet. The rails are of the form shown at *p*, *Fig.* 15, and are screwed down at intervals of eighteen inches on each side, a layer of felt being interposed between them and the timbers. These rails weigh about forty-seven pounds to the yard.—*q*, *Fig.* 15, is the rail of the Great Western railway, which is fixed in a similar manner, but the screws on the inner side of the rail are round-headed and countersunk, while the others are ordinary square-headed bolts. The longitudinal timbers are of larger dimensions, and the cross-pieces or transoms are placed fifteen feet apart, and framed with them, their office being more to keep the track in gauge than to bear any considerable part of the weight.—*r* and *s* are forms of rail sometimes used on continuous bearings, *r* being fastened by clamps or pins driven in obliquely. Rails similar to *p* have been fixed in the same manner, but the use of screws, though expensive, is decidedly preferable.

Fig. 15.



Continuous bearings of stone have been tried, but found too harsh and rigid; and some ingenious combinations of wood or iron with natural or artificial stone or burnt clay, have been proposed, but not hitherto brought much into use.

Gauge, Width between Tracks, &c.—The gauge or width between the two rails forming a track is one of the points in railway practice which has excited much discussion. On the old railways it was of little consequence, provided a good horsepath could be ensured without interfering with the rails. Four feet was not an uncommon width, but many lines were less. Some of the colliery railways in Northumberland are four feet eight inches and a half; and from these the Stockton and Darlington, Liverpool and Manchester, and other lines, took their gauge. The advantage of uniformity has led most companies to follow this example, and for a time it was rendered imperative by parliament, but at present no standard is fixed by the legislature. The ordinary width being considered inconveniently limited, Brunel fixed upon seven feet as the gauge of the Great Western and its tributary lines. Much opposition has been made to this bold step, mainly on account of the inconvenience of not being able to connect with other lines, which is in some degree obviated by laying an inner rail for the use of narrow carriages on any portion of railway passed over by two companies whose lines are laid of different widths. The superiority of this enlarged gauge is apparent in the increased power and speed of the engines, and the stability and convenience of the carriages; but many who admit the inconvenience of the narrow gauge consider seven feet to be beyond the most [illegible]eous width. Six feet two inches has been recommended by the Irish Railway Commissioners. Six feet is the width of some of the continental lines; the Dundee and Arbroath, and Arbroath and Forfar railways are five feet six inches; and the Eastern Counties, and London and Blackwall, about five feet. The ordinary standard in America is four feet eight inches and a half, having been copied from the Liverpool line. Several recent lines in this country have been made four feet nine inches, to allow rather more play to the flanges than the common width. One of the great recommendations of a wide gauge is the scope that it allows for improvements in machinery, a circumstance evidently of much importance when it is considered that the experience of ten years only has led to the enlargement of locomotive engines to so great a degree that their weight and cost are now nearly treble what they were when the Liverpool and Manchester railway was opened. The principal argument on the other side is that by increasing the width and bulk of carriages atmospheric resistance would become more formidable; but Dr. Lardner's experiments lead to the conclusion that this resistance is not affected by the mere *front* of a train so much as to render this objection very important.

The width between the two tracks is a matter of much less consequence, as it has little effect except in limiting the width of load that may be carried. On the Liverpool and Manchester line it is four feet eight inches and a half, which is convenient as allowing waggons to run on it during the construction of the road. The London and Birmingham railway and many others have a space of six feet, which allows loads of ten feet wide to be carried with safety. The same intermediate space on the Great Western railway, in consequence of the increased gauge, allows a maximum load of twelve feet. The space necessary outside the tracks is dependent on the width of load provided for, and seldom exceeds four feet, except on embankments, where a little more is sometimes allowed, so that in case of carriages getting off the track, there may be width for them to run on the ballasting until the inner wheels come in contact with the outer rail, which will in most cases prevent the train from overturning.

In laying the rails, allowance should be made for the effect of temperature, which will cause a difference of length in a fifteen-feet rail, exposed to a range of 76° Fahrenheit, of about $\frac{1}{11}$th of an inch. From want of attention to the temperature when the rails are laid, too much allowance is frequently made, which, especially with square joints, causes an unnecessary shock to the carriages. The insertion of a piece of wood between the ends of two rails is an ingenious mode of avoiding concussion from this cause, the wood expanding as the iron contracts.

In the description of *fig.* 8, it is stated that the wheel-tires are made slightly conical, in order that the flanges may come in contact with the rails as little as possible. In ordinary wheels three inches and a half wide, the inclination of the tire is about 1 in 7, the diameter at the outside being an inch less than close to the flange. The wheels are so fixed that when running straight the flanges are about an inch from the rails. When the rails are fixed vertically, the line of contact between them and the wheels is, in consequence of their conical shape, so narrow as to cause considerable wear. Most engineers therefore give a slight inclination inwards to the rails, that they may present a greater surface to the wheels, although the friction is increased by the rubbing of the conical tire. This inclination is stated by Lecount to be ⅜ of an inch in eleven inches, or about 1 in 29, on the Birmingham railway; on the Great Western it is 1 in 20.

In running on a straight road, the conical tires keep the carriage in the true line of direction, because any deviation from it causes the wheels on one side to roll on an increased and those on the other on a reduced periphery, an irregularity which immediately checks itself. But on a curved track the centrifugal force overcomes that of gravity so far as to cause the flange on the outer side of the curve to approach the rail, and consequently the opposite wheels to roll on unequal peripheries, thereby avoiding part of the friction consequent on the wheels (which are fixed to the axle) being compelled to revolve with equal velocity, though the outer one has to pass over a greater length of rail than the other. To prevent unnecessary friction between the flange and the rail, it is usual to lay the outer rail on curves rather higher than the inner one, that the opposing forces may be so balanced as to cause average loads moving at the medium speed employed to pass round the curve without the flanges on either side coming in con-

yields in a slig

the heavy locom

the rail is thus

tact with the rails, and with the wheels rolling on diameters unequal in a degree corresponding with the radius of the curve. A pair of ordinary coned wheels, three feet diameter, might run in a circle of only 565 feet radius without the flanges touching; and as no curves of such small radius are admitted on a main line of railway, it is evident that, in theory, nothing more than an accurate adjustment of the outer rail with reference to the speed of transit is necessary to enable trains to pass along any ordinary railway without the flanges being called into action, unless by accidental circumstances. The following is selected from a much more extensive table by the Chevalier de Pambour, to show the proper elevation of the outer rail on a line of four feet eight inches and a half gauge, under given circumstances. The calculations are suited to the use of three-feet wheels, coned as above described:—

Radius of Curve.	Speed 20 Miles per Hour.	Speed 30 Miles per Hour.
1000 feet.	1·43 inch.	3·30 inches.
2000 „	·71 „	1·65 „
3000 „	·47 „	1·10 „
4000 „	·36 „	·83 „
5000 „	·28 „	·66 „

Stations, Passing-places, &c.—The convenient arrangement of the stations and depôts on a railway where an extensive and varied traffic is carried on, is a matter requiring much attention. As a general rule it is best to have them as nearly as possible on a level with the surrounding land, both to save expense in construction, and to avoid inconvenience in the transfer of goods from the railway to common road vehicles, and *vice versâ*. Wherever a higher or lower level is unavoidable, approaches of moderate inclination should be made for carriages. The station of the Brandling Junction railway at Gateshead is of novel and ingenious design. The line is on a viaduct, the arches of which are extended so as to support a level of considerable extent. A branch track at right angles with the main line is laid along the crown of each arch, by which waggons are conducted to platforms that form part of the railway level, but may be lowered, with waggons upon them, to that of the warehouses, which are underneath the arches, and communicate with the natural surface. Stations vary in character, from mere booking-offices, where passengers and parcels wait to be taken up by passing trains, to great establishments covering several acres of ground, with separate offices for passengers, parcels, and heavy goods; facilities for transferring carriages, horses, and cattle to or from the railway; extensive sheds for trains to stand under, repairing-shops for engines and carriages, and many other necessary erections. The stations of the London and Birmingham railway at Euston Square, Camden Town, and Birmingham, extend collectively over a space of about fifty acres; besides which the company have establishments of great magnitude at Wolverton, Rugby, and Hampton, and several of smaller dimensions. The original estimate for the stations was 70,000*l.*, but in consequence of the necessity of arrangements for a greater traffic than was anticipated, about ten times that sum has been expended upon them.

Contrivances for conducting engines and carriages from one track to another are required in a variety of situations. They generally consist of switches and turntables, so modified as to suit particular cases. Switches are moveable rails placed at the point where two tracks fall into one, and capable of adjustment so as to guide vehicles from the single track into either of the two, or from either of the two into the single track. In the old railways this was effected by short *tongues* of iron, moved by hand; but it is necessary where locomotives are used to have the transition from one track into the other as gradual and free from concussion as possible, and therefore the moveable bars are made of considerable length, seldom less than eight or ten feet, and, on the Great Western railway, fifteen feet. *Fig.* 16 represents a switch formed on the model of the old contrivance of moveable tongues. The black lines are the fixed rails, which at A form but one, and at B two tracks. The double line from *c* to *d* indicates the switch, which is pivoted at *d*, and tapered to a point at the other end. From its under edge proceeds the bar *e*, which passes under the rail to a lever or eccentric placed in a convenient situation for being moved by an attendant. In the position represented by the engraving, the switch would conduct a train along the upper track from A to B, because free passage is allowed for the flange between the switch and the upper rail, while the inside of the flange pressing against the switch *c d* prevents the flange on the opposite side of the track from quitting the straight course. If however, by turning the lever or eccentric connected with *e*, the switch is moved in the direction indicated by the arrow, the case will be reversed: the switch being brought into contact with the rail at *c*, the flange will be compelled to move along its inner side, and consequently that on the opposite side of the track will pass along the opening by the side of the lower rail. *f f* are fixed bars called guard-rails, which prevent the switch moving too far, and protect the narrow ends of the switch and rail from injury. Switches on this principle sometimes connect three tracks with one by *two* moveable pieces, of which an example is in use at the Great Western railway station at Paddington. A great recommendation of this kind of switch is, that unless the moveable rails are *fixed* in a wrong direction, a train can never get off the track, as the momentum enables the flange to open the switch and pass through. In some situations a spring or weight is applied with great advantage, to hold the switch in the position most commonly required, and return it to that position immediately after being acted upon. The double rail, represented in *fig.* 17, is a contrivance much used as a switch, and affords a very smooth transition from one track to another. In this the two tracks terminate in two double rails, *c d* and *c′ d′*, pivoted at *d d′*, and shifted as occasion requires in a similar manner to the former, the rails being connected by cross-pieces, so that the whole are moved simultaneously. In the present position of the apparatus the lower track is that connected with the single line; but by moving the switches in the direction of the arrow, the lower track would be disconnected, and the upper one made to join the track at A. These switches, like those previously described, are occasionally used treble; and they are sometimes made to unite two tracks in each direction. Several other varieties are used, which it is needless here to particularise.

Fig. 16.

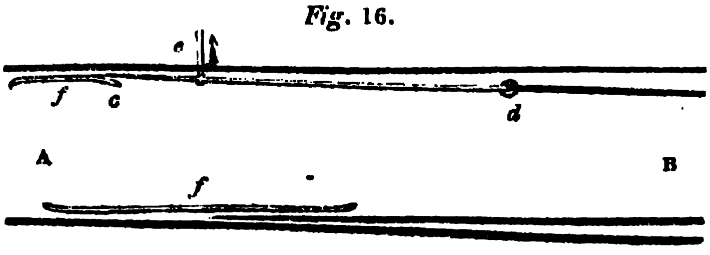


Fig. 17.

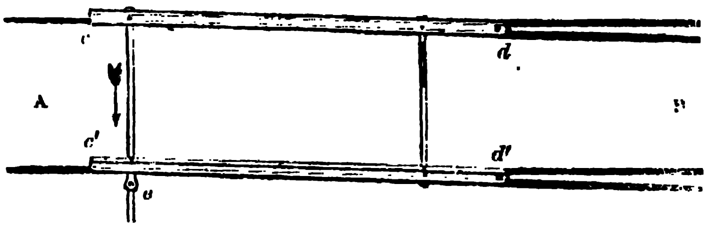
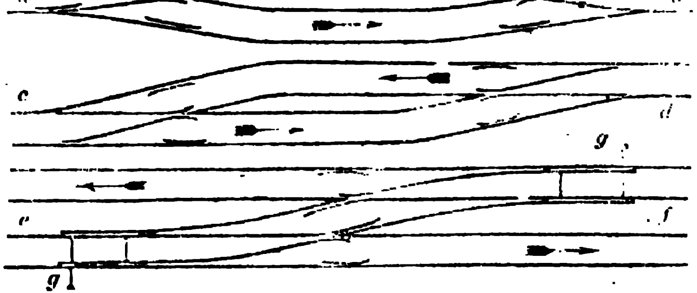


Fig. 18 is designed to illustrate the manner in which switches are applied at passing-places and crossings. *a b* is a passing-place for a single line of railway where the traffic is about equal in each direction. It should be observed that the angles in this figure are, to save room, made more abrupt than they should be on a public railway, where angles of more than 2° or 2½° are considered objectionable. In this arrangement every train from *a* to *b* takes the lower track, and those from *b* to *a* the upper one. Switches of

Fig. 18.

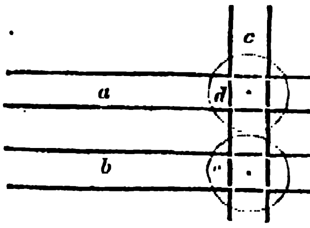


the kind first described are used at the points *a* and *b*, and, as they have always to be passed through in the same order, they are made self-acting, that at *a* being held by springs in the position for guiding carriages on to the lower track, and being opened by the flanges of the engine-wheels for the passage of the trains in the contrary direction, while that at *b* in like manner conducts trains passing towards *a* into the upper track. This kind of passing-place has been successfully used on the Newcastle and Carlisle and other railways. *c d* represents another arrangement for the same purpose, which may have the same kind of switch, but is generally used without any, the impetus of the train always keeping it to the straight track, while, if suitable openings be made for the flanges, it cannot escape from the rails in running from the double into the single part. *e f* shows the arrangement of a crossing on a railway with two tracks, switches being placed at both junctions, which, being only for occasional use, are worked by hand, men being stationed at *g g* for the purpose. Owing to the accidents which occur when switches in such situations, or at the junction of two main lines of railway, are neglected or misplaced, plans have been proposed, but not brought into use, for placing them under the command of the engineer of an approaching train, who cannot be absent from his post. It is usual to affix a signal apparatus to them, which, by displaying a coloured disk of wood or stretched canvass to the engine-driver, informs him of the position of the switches as he approaches them, and affords an opportunity of checking his speed if they are wrong.

At the points where two rails cross, grooves are formed to allow the flanges to pass; and, to check any tendency in the wheels to escape from the rails, guard-rails, as indicated in *Fig.* 18, are fixed within the track, to guide the inside of the flanges.

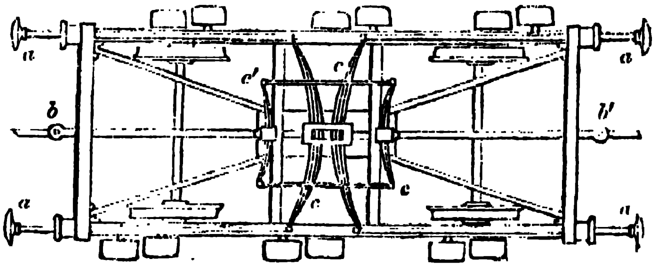
Turn-tables are useful in transferring single carriages from one track to another, which they do in much less space than any arrangement of crossings and switches. They consist of circular platforms of iron and wood, fixed on a level with the tracks, and mounted on friction-wheels, so as to turn on their centres with great facility. *Fig.* 19 represents two turn-tables so laid as to communicate with one another. Four rails are laid across each, and made to tally precisely with those of the track. If it be desired to transfer a carriage from the track *a* to that marked *b*, it is rolled on the turn-table at *d*, and then, the catches which hold the turn-table steady being released, the platform, with the carriage upon it, is turned a quarter round. The carriage is then rolled on the turn-table *e*, and being again turned a quarter of a circle, is in a right position for running on the track *b*. Carriages may in like manner be transferred to a cross-track, as at *c*. Locomotive-engine houses are frequently made octagonal, with eight radiating tracks, the engines being moved to or from any of them by means of a large turn-table in the centre. That at Camden Town has sixteen tracks connected in this manner.

Fig. 19.



Carriages.—Railway carriages for the conveyance of passengers are usually very capacious, the bodies being made to project over the wheels, which on ordinary lines seldom exceed three feet diameter. This arrangement is not productive of danger, since the evenness of a railway, the comparatively low build of the carriages, and the great weight of the iron wheels, axles, and framing under the body, prevent the liability of overturning. On account of the rapid speed at which they travel, and the violent shocks to which they are occasionally subject, great strength of construction is necessary; and the circumstance of several vehicles being linked together in one train renders the use of an elastic apparatus for starting and stopping them essential, both for the safety and comfort of passengers, and the protection of the vehicles themselves. Elasticity in the traction is also necessary, in order that the engine may not have to overcome the inertia of the whole train at the same instant, which would require much more power than suffices, when they are started, to keep the whole in motion. Various contrivances, more or less complete and effective, are in use for this purpose, but *fig.* 20 may serve to give a correct idea of the principles on which they all act. It represents the ground-plan of a passenger-carriage, the body being removed. The frame, which is outside the wheels, is supported on lapped springs, which, by brass bushes or bearings, rest on the ends of the axles, they being extended beyond the wheels, and accurately turned, for that purpose. *a a a a* are buffers, or discs of wood or metal, sometimes covered with cushions, fixed on the ends of long rods which pass through the frame and along the sides to the ends of the long springs *c c*, which are capable of moving towards each other when pushed by the rods, but are prevented by stops on the frame from moving in the opposite direction. The centre being allowed to slide backwards and forwards, both springs are brought into action by an impulse given to either end. All the buffers in a train being placed at the same height and width, they come into contact when the carriages run towards one another in stopping suddenly, and the jerk is by them communicated to the springs *c c*, whose elasticity allows so much motion as to prevent any injurious shock to the carriage. The traction apparatus, or that by which the carriages are drawn forward, consists of rods passing through the frame at *b b′*, and connected in a manner which it is unnecessary to describe, with the small springs *e′ e*, which also act together, the centre of *e* pressing against the cross-bar of the carriage-frame as an abutment, when the pull is from *b*, and that of *e′*, in the like manner, when the traction is in the direction of *b′*. The connection between the different carriages often consists of a jointed bar of iron, which is disconnected, when necessary, by the removal of a pin. Chains are sometimes used, and occasionally united by a peculiar kind of screw, which draws the carriages so close that their buffers come in contact. In some carriages the same springs serve both for traction and buffing, and spiral or helical springs are not unfrequently applied to the purpose. Axle-guides, fixed to the framing, are used to keep the axles square; but a more elastic construction of carriage, in which the axles have sufficient play to enable them to adapt themselves to a curved track, and the springs for bearing the weight, drawing, and buffing, are made of an unusually light character, is being introduced by Mr. Adams, with great promise of success. Many engineers appear to be of opinion that the construction of carriages, as well as of the railroad itself, has hitherto been too rigid, and Mr. Adams conceives that the adoption of his bow-springs, and other improvements, will at once increase the comfort and safety of railway conveyance, and diminish the wear and tear, which, with the present heavy and comparatively inelastic carriages, is very great. The ordinary first-class carriages convey eighteen passengers, having a treble body, with six seats in each compartment; and the second-class, of similar make, carry twenty-four passengers. Those on the Great Western railway, which are mostly on six wheels, are much larger, some of the second class vehicles seating seventy-two persons. The wide gauge allows the use of bodies so large that some are fitted up as elegant saloons. A splendid carriage, about twenty-eight feet long and nine wide, has been recently prepared for the use of Her Majesty and suite, when travelling on this line. Open carriages, in which the passengers stand, are frequently used for short stages. Waggons for goods and cattle, trucks for the conveyance of stage-coaches and private carriages, and horse-boxes, are all mounted on springs, but their buffing-apparatus is often very simple and inelastic. The weight of the ordinary passenger-coaches, when empty, is mostly from three to five tons.

Fig. 20.



Locomotive Engines.—In the rapidly extended application of locomotive steam-engines since their successful adoption on the Liverpool and Manchester railway, improvements have followed closely upon one another, but they have been chiefly of a minor character, when compared with that of tubing the boiler, which formed the distinguishing feature of the Rocket engine. Stephenson built several engines shortly after the competition in which the Rocket had proved victorious, retaining this arrangement, but having the machinery disposed in a different manner. The cylinders were placed in a box beneath the chimney, and the piston-rods moved horizontally under the boiler, working two cranks formed on the axle of the hind-wheels, which were then made the largest. The boiler and machinery were attached to a massive frame, the sides of which were outside the wheels, and rested, by means of springs and brass bearings, on the ends of the axles. Bearings outside the wheels have this decided advantage over inner ones,—which are nevertheless preferred by some engineers,—that the ends of the axles may be turned away to so small a diameter as materially to diminish the friction, without the risk of breakage which would attend the reduction of the axle within the wheels. The superior economy of large engines becoming evident from experience, it was deemed advisable to add a third pair of wheels, which were made small, like the fore-wheels, and placed under the fire-box end of the machine. The flanges on the two pair of small wheels being sufficient to guide the machine, Stephenson removed them from the central or driving pair, which thus became more rolling or propelling wheels, and were relieved from the lateral strains arising from the flange coming in contact with the rail at curves and switches, such strains having been found injurious to the cranked axle and the machinery connected with it. Some engine-builders still retain all the flanges, from an idea of greater security. The following figures may give some idea of the locomotive engine in this improved state, in which form it is now in use upon most of the railways in this country, and several on the Continent and in America. *Fig.* 21 is an elevation, and *fig.* 22 a longitudinal section, in which many minute details are omitted, for the sake of distinctness.

Fig. 21.

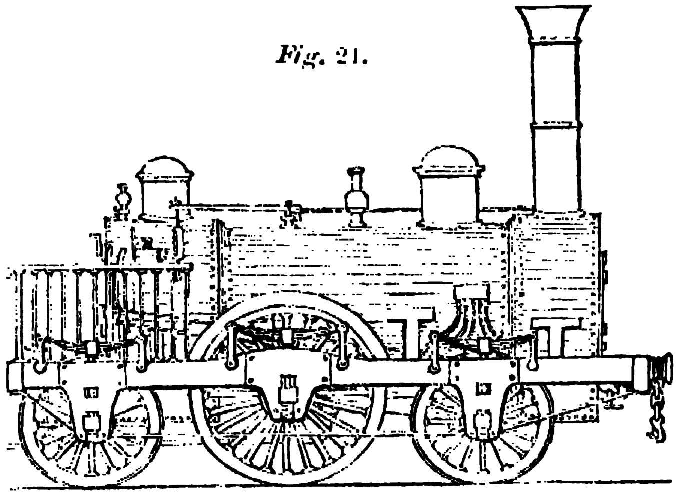
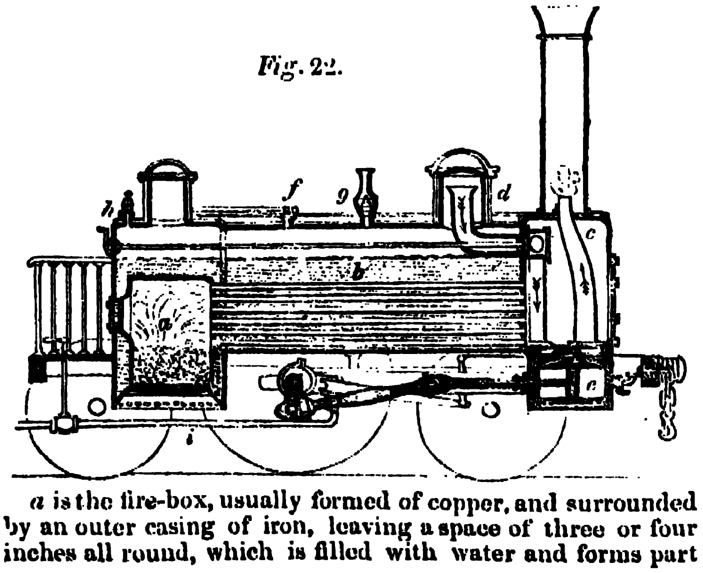


Fig. 22.



a is the fire-box, usually formed of copper, and surrounded by an outer casing of iron, leaving a space of three or four inches all round, which is filled with water and forms part of the boiler. The door by which the fire is supplied with coke is made of two iron plates, with a space of a few inches between them, to prevent the radiation of heat. Coke is carried in the tender, a supplementary vehicle attached to the back of the engine. The fire-box is usually open at the bottom, to allow the free access of air, so that cinders fall through the bars upon the road, a circumstance sometimes productive of accident. As there is very little water above the flat top of the fire-box *a*, a fusible plug is inserted in it, to act as a safety-valve in the event of the water becoming too low, and leaving it dry. The tubes through the boiler *b* for the passage of flame and heated air are now always made of brass, which is found much more durable than copper. They vary in number in different engines from about ninety to a hundred and fifty or upwards, being frequently less than an inch and a half in diameter. The power of generating steam, which is the measure of efficiency in a locomotive engine, depends much upon judicious tubing, it being desirable to deprive the heated air of its caloric as completely as possible before leaving the boiler. The chief practical limit to the reduction of the tubes, and consequent increase of their number and extent of surface, is their liability to become choked with cinders and ashes carried into them by the draft. Boilers are frequently tubed to such an extent that from four to six hundred square feet of heated metal is exposed to the water, in addition to the area of the fire-box itself. An important feature in a locomotive boiler is its security from bursting, because, as the tubes are much weaker than the external casing of the boiler, they are almost certain to give way first, and the bursting of one or two tubes is rarely productive of more serious consequence than extinguishing the fire, and thereby causing a gradual stoppage of the machine.

Owing to the limited size of the boiler, the steam which collects in the upper part is mixed with spray from the water. A steam-chamber *d* is therefore added, in which it becomes free from the spray, and then enters the steam-pipe that passes through the smoke-box *c* to the cylinders or engines at *e*. A throttle-valve in this pipe is placed under the command of the engineer by a rod passing through the boiler and terminating in a handle connected with a graduated scale at the back of the engine. By this the supply of steam to the cylinders is regulated or cut off when necessary. The action of the pistons and connecting-rods needs no explanation here. Eccentrics for working the slide-valves, which admit steam alternately to each side of the piston, are fixed on the main crank-axle, and in some engines two pair are used, one for working in common, and the other when the engine runs backwards. The steam cylinders are usually twelve or thirteen inches diameter, and eighteen inches stroke; and the driving-wheels of the engine from five to seven feet diameter, the small wheels being three or four feet. Driving-wheels of eight and ten feet diameter have been tried on the Great Western railway; but the most common diameter on that line is seven, and on railways of the ordinary gauge five or six feet.

The pipe shown in the section passing from the cylinders to the chimney is the blast-pipe for the exit of waste steam, its upper end being tapered to give greater effect to the jet. At the top of the chimney a wire-gauze cap is frequently fixed to arrest sparks and small cinders which are often thrown up by the strong draft, and have been the occasion of many destructive fires; but a more effectual remedy has been recently introduced, consisting of a grating at the bottom of the chimney, which stops the cinders before they are affected by the steam-jet. *f* and *g* are safety-valves held down by springs the former only being under the control of the engine-driver. *h* is a steam-whistle, which by its shrill sound warns persons working on the line of the approach of an engine. *i* is one of two feed-pipes, communicating between the water-tank in the tender and small forcing-pumps under the boiler, which are worked by the engine, and ensure an equable supply of water in the boiler. Valves for regulating this supply, handles for reversing the motion of the machine, steam and water gauges, and numerous other conveniences are added, being placed within reach of the engine-driver, when on the platform at the back of the fire-box. In order to economise the heat by checking its radiation, the boiler is coated with wood, and sometimes flannel is placed between them. The steam-dome and similar parts are double, the space between the inner and outer casing answering the same purpose. The tender, and sometimes the engine itself, is supplied with powerful brakes, to arrest the motion of the wheels when necessary. Some of the carriages also have them, handles for working them being placed within reach of the guards.

On some lines of railway, as the London and Birmingham, engines on only four wheels, with circular fire-boxes, and the axle-bearings within the wheels, are still used; and some engines have been recently introduced on the Hull and Selby railway, in which an attempt is made to combine the advantages of inside and outside bearings, by throwing a great part of the weight on bearings within the central or driving-wheels, while steadiness of motion is insured by external bearings to the fore and hind wheels. Where increased adhesion is desirable, as for luggage engines, or such as are intended to ascend steep gradients, four, or even six wheels are coupled together by external cranks and connecting rods, such wheels being of course of equal diameter.

Many of the American locomotives are arranged in a different manner from that described, with a view to greater facility in passing along curves; the forepart of the machine being supported on a four-wheeled truck, which is capable of adjusting itself to a curved track. It is a singular fact that while British engines have been sent to America for working several lines, an American manufacturer has competed successfully with those of England in building locomotives for the Birmingham and Gloucester railway.

Harrison's patent locomotive, though not extensively introduced, deserves mention for its bold departure from the established model, the boiler and engines being mounted on separate carriages. These have been built with ten-feet driving-wheels, and also with five-feet wheels, the velocity of which is made treble that of the cranked axle by the intervention of a toothed wheel and pinion. Hitherto no very striking advantage has been realised by these arrangements.

Stationary Engines.—The heavy expenses attending the use of locomotive engines, from the rapid action of the working parts, the addition of their own weight to the load to be conveyed, and the injury they cause to the rails, lead some persons to conceive that stationary engine-power might be applied more advantageously. The working of stationary engines themselves is unquestionably the most economical, but the friction of ropes to convey their power to the carriages forms a serious drawback. Hitherto they have been little used except for steep inclined planes, which, as at Camden Town and Liverpool, are worked by an endless rope, conducted along both tracks by grooved pulleys or sheaves, to keep it off the ground, and passing at each end round a wheel fixed below the level of the road, the upper one of which is turned by the engine. A contrivance is added to keep the rope always at the requisite degree of tension. It has been proposed, in hilly countries, to use natural or artificial falls of water instead of steam-engines for such an apparatus. Another mode of employing the power of stationary engines is by means of what are called *tail-ropes*, an ingenious application of which has been recently adopted on the London and Blackwall railway, and seems well adapted for working a railway in which numerous stations are required within a short distance. Very powerful engines are erected at London and at Blackwall, each of them turning a grooved wheel, to which a rope of nearly six miles and a half (double the length of the railway) is attached. A train starting from London is arranged with the Blackwall carriages foremost, and then those for the intermediate stations in such order that the vehicle required to stop first shall be last in the train. At a given signal, the Blackwall engine commences winding up the rope, by which the train is drawn forward at a speed of twenty to thirty miles per hour. On approaching the first station, the carriage intended to stop there is detached from the train by the guard, and stopped by means of a brake, the rest of the train proceeding without interruption; and, in like manner, vehicles are left behind at all the stations. In addition to drawing the train, the Blackwall engine unwinds the rope from the barrel of that at London, which is thereby prepared for moving the train back again when reloaded. In returning each carriage is attached to the rope, and the whole are drawn simultaneously, though on different parts of the line, towards the London terminus, where they arrive at different times, but in the proper order for another journey. This description applies to one track only, but the line has two, each having a similar apparatus, and being worked alternately in both directions. The necessary signals are made by an electric telegraph, invented by Messrs. Wheatstone and Cooke. This important appendage to a railway is described in the article TELEGRAPH. However desirable rope-traction may be under the peculiar circumstances of the Blackwall line, it is attended with great expense from the wear of the ropes, which are very costly; and, notwithstanding every precaution, the noise of the numerous sheaves that support the rope is annoying. To obviate these objections is a principal object of the invention called the 'atmospheric railway,' which, within a few months past, has been successfully tried on a length of about half a mile on the West London (formerly called the Thames Junction) railway, at Wormholt Scrubbs. The apparatus consists of an iron pipe nine or ten inches diameter, extending along the middle of the track; in which a piston is caused to move with a velocity of from twenty to thirty miles an hour, by exhausting the tube in front of it, and admitting the air to press on the opposite side. A connection is formed between this piston and the carriages by a rod passing through an opening along the top of the tube, which is kept air-tight by a well-contrived valve that opens to allow the passage of the rod. The necessary vacuum is produced by air-pumps, worked by a stationary steam-engine. Though several similar propositions have been previously made, that of Mr. Pinkus being, except in the kind of continuous valve used, almost identical with the present, the credit of proving the practicability of the principle on a large scale is due to Messrs. Clegg and Samuda, who anticipate advantages from it which it would be premature here to enumerate. One, which applies alike to all plans of working with stationary engines, is the improbability of collision, as but one train can be moved upon the same engine length of railway at once; as a set-off to which there is the inconvenience that a casualty to one part of the apparatus deranges the working of the whole line.

When railways were first proposed for the purposes of general traffic, it appears to have been considered that competition in the supply of locomotive power and travelling accommodation might be advantageously encouraged: and consequently clauses were introduced in railway Acts to enable any person to run engines and carriages on the payment of certain specified tolls, and subject to such regulations as might be made by the company to whom the road belongs. Such powers have been very rarely put in practice, and it is obvious that they may be virtually nullified by the refusal, on the part of the company, to supply some necessary facilities. But if such were not the case, it is the deliberate opinion of the late Parliamentary Committee, founded on careful inquiry, 'that it is indispensable, both for the safety and convenience of passengers and the public, to prohibit, as far as locomotive power is concerned, the rivalry of competing parties on the same line of railway;' also 'that railway companies using locomotive power possess a practical monopoly for the conveyance of passengers on the several lines of railway; and that under existing circumstances this monopoly is inseparable, from the nature of their establishments, and from the conduct of their business, with due regard to the safety and convenience of the public.' As far as regards the supply of locomotive power and the general control of the trains, a similar arrangement is essential in conducting the traffic in merchandise; but much difference of opinion exists as to the best system of managing this department of business. Some companies merely supply locomotive power and carriages, leaving the details of the business in the hands of the carriers; some have a complete monopoly of merchandise traffic, the companies acting as carriers themselves; and others combine the two systems, the companies being carriers, but conveying goods for private carriers also. On these and various other points much interesting and valuable information will be found in the 'Reports of the Select Committee on Railway Communication,' in the sessions of 1839 and 1840, with the voluminous evidence and appendices. These enter upon many subjects that have been necessarily omitted here for want of space, one of which is the passenger-tax, which is levied under the Act 2 & 3 Will. IV., c. 120, and amounts to one-eighth of a penny per mile for every passenger carried. The Committee, in order to encourage railway companies to extend the benefit of their undertakings by low fares, recommended a graduated tax, to press very lightly on the lowest fares, and form an increasing per centage as they rise to the highest rate allowed. At the recommendation of this Committee, an Act has been passed for the regulation of railways (3 & 4 Vict., c. 97), which requires that a month's notice shall be given to the Board of Trade before the opening of any railway, or portion of railway, for the conveyance of passengers or goods; and empowers the Board to call for returns from the railway companies of the amount of the various descriptions of traffic, of all accidents attended with personal injury, and of all tolls, rates, and charges levied on passengers, cattle, and goods. The Board of Trade are also allowed to appoint inspectors, who may enter upon and examine the works, stations, engines, carriages, &c. of any railway company; such inspectors not to be persons who have held any office of trust or profit under a railway company within one year of their appointment. The Act further provides for the prosecution at the public expense of companies who may not have complied with its provisions or those of any other Act under which they are regulated; and for the punishment, by fine or imprisonment, of the servants of railway companies, or any other persons wilfully, maliciously, or negligently endangering the safety of the works or carriages, or of the passengers conveyed, and of persons trespassing upon the line or stations. The power of arbitration in certain cases of dispute, and of confirming or disallowing any bye-laws of the companies, is also vested by this Act in the Board of Trade, whose new functions bid fair to be the means of collecting much important and interesting information on various points of railway economy. The conveyance of mails on railways is regulated by the Act 1 & 2 Vict., c. 98.

(Wood's *Practical Treatise on Railroads*, &c., 3rd edition, 1838; and Lecount's *Treatise on Railways*, reprinted from the new edition of the 'Encyclopædia Britannica,' are among the most generally useful works on the subject of this article.)

British Railways.

The railways laid down before the present century were mostly of very limited extent; and being for the use of private establishments, were usually formed without the authority of an act of parliament. The earliest railway Act that has come under the notice of the writer is a private act of the 31st Geo. II., 1758, respecting a waggon-way for the conveyance of coal to Leeds, an undertaking interesting from its having been worked for some years by Blenkinsop's patent locomotive engines, with toothed driving-wheels working into a rack-rail. Several of the early canal Acts contained clauses empowering the companies to lay railway branches or to make railways instead of canals in certain situations where difficult works or extensive lockage would otherwise occur. The first railway established in this country as a distinct undertaking, and intended for public use, was the Surrey iron railway, the company for which was incorporated in 1801.* In the following twenty years only twenty new railway companies were incorporated; but the Stockton and Darlington railway, the Act for which passed, after much opposition, in 1821, gave an impulse to this kind of enterprise. It was opened in 1825, and accomplished far more than any previous line had done in adapting railway communication to the purposes of ordinary commercial intercourse. The annexed table shows the number of undertakings in the ten years immediately succeeding this event to have been fifty-four, of which, though many were of minor importance, several were passenger railways, and adopted locomotive engines as the moving power. The years 1836 and 1837 added forty-four more to the list, most of which were extensive undertakings. Alterations in the mode of obtaining railway Acts, combined with other circumstances, have imposed such a check on new projects, that only five have been sanctioned since that time, although the number of Acts for alterations and extensions, and for raising additional capital, has been considerable. The following table shows the number of railway Acts passed from 1801 to 1840, distinguishing those for new undertakings from such as give amended or enlarged powers to companies previously incorporated. Acts empowering canal companies to lay railways are not included.

Year.	New Lines.	Amendments.	Total.	Year.	New Lines.	Amendments.	Total.
1801	1	0	1	1822	0	1	1
1802	2	0	2	1823	0	1	1
1803	1	0	1	1824	2	1	3
1804	1	0	1	1825	8	1	9
1805	0	1	1	1826	10	1	11
1806	0	2	2	1827	1	5	6
1807	0	0	0	1828	5	5	10
1808	1	0	1	1829	5	4	9
1809	3	0	3	1830	5	3	8
1810	1	1	2	1831	5	4	9
1811	3	1	4	1832	5	4	9
1812	2	1	3	1833	5	6	11
1813	0	0	0	1834	5	9	14
1814	1	1	2	1835	8	11	19
1815	0	1	1	1836	29	6	35
1816	1	0	1	1837	15	27	42
1817	1	0	1	1838	2	17	19
1818	1	0	1	1839	3	24	27
1819	1	0	1	1840	0	24	24
1820	0	1	1				
1821	2	1	3		135	164	299

The total length of the lines sanctioned by acts of parliament is near 3000 miles, of which a few have been either partially or entirely abandoned. Omitting lines of little public interest, those intended for the conveyance of passengers and merchandise by steam-power amount to upwards of 2000 miles, of which more than 1100 miles are now in operation. The total amount of capital is 68,825,293*l.*, of which near one-third is allowed to be raised by loan. Deducting the capital of lines not proceeded with, or of only private interest, and making ample allowance for sums authorised, but not required, it appears that about 60,000,000*l.* has been invested in this country alone, in the introduction of a system which, but a few years since, had to struggle into existence through opposition arising perhaps as much from incredulity and ignorance as from self-interest.

The prospects of success as commercial undertakings are very different, but railways have invariably been found greatly to increase the amount of travelling, and the receipts of those lines which have been longest in operation are truly surprising. On the 260 miles of railroad connecting London, Birmingham, Liverpool, Manchester, and Preston, with the branch to Aylesbury, the gross receipts for the year ending June 30th, 1840, were 1,467,562*l.* 19*s.* 8*d.*, or upwards of 5644*l.* per mile; and this astonishing amount of income seems likely to be materially exceeded in future.

The following tables contain every railway for which an act of parliament has been obtained since 1801, with the exception of eleven: the Anglesey, 1812; Berwick and Kelso, 1811; Dulais, 1826; Exeter and Crediton, 1832; Limerick and Waterford, 1826; Manchester and Oldham, 1826; Peak Forest, 1816; Rutherglen, 1831; Sheffield and Manchester, 1831; Usk, 1814; and West Lothian, 1825; none of which have been executed, or are likely to be so. There are some private undertakings, as the Stanhope and Tyne, Stockton and Hartlepool, &c., which are of more general interest than many contained in the table; but as it would be difficult to draw a line of separation, it has been considered better to exclude all for which parliamentary powers have not been procured; and, with the exceptions just named, to embrace all which have been so sanctioned. The number prefixed to each line is merely for convenience of reference. The date of opening, when not otherwise stated, is that of opening throughout, and where the precise period could not be ascertained, a dash is inserted to indicate that the line is completed. The length given is generally exclusive of branches. In the column of 'Original capital' the first line shows the amount of that in joint-stock, which usually indicates the estimated expense of the works; the second, the further sum allowed by loan or new shares; and the third, the total sum authorised by the act of incorporation. In the second column of capital the same arrangement is not maintained, because it is frequently optional with companies to raise additional sums by loan or new shares. The sum in this column sometimes exceeds the outlay of the company, owing in some cases to the issue of shares at a sum considerably under their nominal value; and in others, to the company having taken powers for raising money to a greater extent than has proved necessary. Where the second column of capital is blank, it intimates that no powers for raising additional money have been obtained.

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* Tredgold, in his 'Practical Treatise on Railroads,' &c., 1825, mentions a railway Act of the year 1794, for making a tramway from Merthyr Tydvil to Cardiff. Such a railway, or part of it, was formed, and the experimental locomotives of Trevithick were tried upon it in 1805; but the Act, if such were really passed, has eluded the search of the compiler of the following tables, although his examination has extended back as far as 1771. The length of the line, which is chiefly used for iron-works near Merthyr, is variously stated from about nine miles to twenty-six and three-quarters. The difficulties arising from conflicting statements, as well as, in some cases, from the paucity of circumstantial information, will, it is hoped, form some excuse for omissions and minor errors in the tables.

RAILWAYS OF ENGLAND AND WALES.

NAME.	COURSE.	Date of Act.	Date of Opening.	Length in Miles.	Branches, &c.	Power used.	Original Capital.	Present Capital.	REMARKS.
1. Avon and Gloucestershire.	No. 13 at Mangotsfield, to the Avon, near Bitton, Gloucestershire.	1828	1832	4½	To collieries. Joins No. 13.	Horses	£21,000 10,000 31,000	£46,000	To connect quarries and collieries with the Avon. Gauge, 4 ft. 8½ in.
2. Aylesbury . .	No. 53 at Cheddington, 35 m. from London, to Aylesbury, Bucks.	1836	1839	7	Joins No. 53.	Locom. Engines.	50,000 16,000 66,000	..	For passengers and general traffic. Leased to No. 53 company. Gauge, 4 ft. 8½ in.
3. Birmingham & Derby Junction.	Nos. 4, 33, and 53, at Birmingham, to Nos. 65 and 71 at Derby.	1836	Part 1839	Total 48½	To No. 53, at Hampton. *See* 4, 33, 53, 65, & 71	Locom. Engines. 2 incl. pl.	630,000 200,000 830,000	1,056,666	For passengers and general traffic. Gauge, 4 ft. 8½ in.
4. Birmingham & Gloucester.	Nos. 3 and 53 at Birmingham, to No. 17 at Cheltenham, and by it to Gloucester.	1836	Part 1840	45 Brs. 8	To Tewkesbury, &c. Joins 3, 17, and 53.	Locom. Engines.	950,000 316,666 1,266,666	..	For passengers and general traffic. The company to use 6½ m. of No. 17. Gauge, 4f. 8½ in.
5. Bishop's Auckland and Weardale.	Black Boy Branch of No. 87, to Witton Park Colliery, all in Durham.	1837	In progress.	..	To Crook. Joins No. 87.	Locom. Engines allowed.	72,000 24,000 96,000	..	For the conveyance of coal, passengers, &c.
6. Blaydon, Gateshead, and Hebburn.	No. 68 at Blaydon, by Gateshead, to Hebburn Quay, on the Tyne.	1834	..	..	Several allowed. *See* Nos. 34 and 68.	..	60,000 20,000 80,000	..	Part of the line was bought by No. 68 company.
7. Bodmin & Wadebridge.	From near Bodmin to Wadebridge, parish of St. Breoke, Cornwall.	1832	1834	12	To Bodmin, &c.	Locom. Engines.	22,500 8,000 30,500	35,500	For minerals, passengers, &c. A single track, 4 ft. 8½ in. gauge. Speed abt. 8 m p' h.
8. Bolton & Leigh	Bolton to the Leeds & Liverpool Canal at Leigh, Lancashire.	1825	June, 1831	7½	Joins Nos. 44 & 61.	Locom. & fixed Engines.	44,000 in shares.	170,500	For minerals, merchandize, passengers, &c. A single track; gauge, 4 ft. 8½ in.
9. Bolton and Preston.	No. 61 at Bolton, by Chorley, to No. 72 at Euxton, Lancashire.	1837	In progress.	14½	Joins Nos. 61 & 72.	Locom. Engines intended	380,000 126,000 506,000	..	For passengers and general traffic. Originally intended to run direct to Preston.
10. Brandling Junction.	No. 68 at Redheugh, through Gateshead, to South Shields and to Monkwearmouth.	1835	Sept. 1839	Total 15½	Joins No. 68.	Locom. eng. some incl. pl.	110,000 36,000 146,000	400,000	For passengers, coal, and general traffic. Gauge, 4 ft. 8½ in.
11. Bridgend . .	No. 25 at Laleston to the town of Bridgend, Glamorganshire.	1828	1834	4½	Joins No. 25.	Horses	6,000 4,000 10,000	..	For the conveyance of minerals, &c. The line rises 190 feet.
12. Bristol and Exeter.	No. 36 at Bristol, passing near Bridgewater and Taunton, to Exeter.	1836	In progress.	75½ Brs. 8	Six Branches proposed. Joins No. 36.	Locom. Engines intended.	1,500,000 500,000 2,000,000	..	For passengers and general traffic. Gauge, 7 ft. To be leased to No. 36 company.
13. Bristol & Gloucestershire (Old line).	Bristol to Coalpit Heath, parish of Westerleigh, Gloucestershire.	1828	Aug. 1835	9	Joins No. 1. *See* also No. 14.	Horses	45,000 12,000 57,000	77,000	For the conveyance of coal, stone, &c. Gauge, 4 ft. 8½ in. A tunnel 1540 ft. long.
14. Bristol & Gloucester (Extension line.)	No. 13 at Westerleigh, 7½ m. from Bristol, to No. 17, at Standish, 4½ m. from Glouc.	1839	In progress.	22	Joins Nos. 13 & 17.	Locom. Engines intended.	400,000 133,000 533,000	..	For passengers and general traffic. Intended gauge, 4 ft. 8½ in. No. 13 to be improved.
15. Caermarthenshire.	"The Flats," Llanelly, to Llanvihangel Aberbythick, Caermarthenshire.	1802	1804	16	Several, to collieries, &c.	Horses	25,000 10,000 35,000	53,000 See no	A plate railway, now (1840) fallen into disuse. te (*a*).
16. Canterbury and Whitstable.	City of Canterbury to the Sea Shore at Whitstable, Kent.	1825	May 1830	6½	Short Branches allowed.	Locom. & fixed Eng. &c.	31,000 in shares.	111,000	For coal, passengers, &c. A single track; rises 422 feet. A tunnel 822 yards long.
17. Cheltenham & Great Western Union.	No. 36 at Swindon, by Cirencester, Stroud, and Gloucester, to Cheltenham.	1836	In progress.	43½ Br. 4	To Cirencester. Joins Nos. 4, 14, and 36.	Locom. Engines intended	750,000 250,000 1,000,000	..	For passengers and general traffic. Gauge, 7 ft. Part to be leased to No. 36 company.
18. Chester and Birkenhead.	No. 19 at Chester to near the River Mersey at Birkenhead, Cheshire.	1837	Sept. 1840	14½	Joins No. 19.	Locom. Engines.	250,000 83,333 333,333	499,999	For passengers and general traffic. Gauge, [illegible] 8½ in.
19. Chester and Crewe.	No. 33 near Crewe Hall, Cheshire, to No. 18, at Brook Street, Chester.	1837	Oct. 1840	20½	Joins Nos 18, 33, and 60.	Locom. Engines.	250,000 83,333 333,333	458,333	For passengers and general traffic. Gauge, 4 ft. 8½ in. United to No 33 in 1840.
20. Clarence . .	The Tees, at Port Clarence, 4 miles from Stockton, to No. 87, at Sim Pasture.	1828	—	Total 36	Several. Joins 26, 34, 35, 87, and 91.	Chiefly Locom. Engines.	100,000 60,000 160,000	500,000	Chiefly for coal, &c., but some passengers conveyed. Gauge, 4 ft. 8½ in.
21. Coleorton . .	No. 49, at Swannington, to collieries, &c., at Coleorton, Leicestershire.	1833	—	..	Joins No. 49	Horses	25,000 6,000 31,000	..	For the conveyance of coal, &c. Gauge, 4 ft. 8½ in.
22. Cromford and High Peak.	The Cromford Canal, near Cromford, to the Peak Forest Canal at Whaley Bridge.	1825	1830	33	. . .	Fixed Eng. and Horses.	164,400 32,880 197,280	..	For minerals, merchandize, &c. Rises 990 ft. from the Cromford Canal.
23. Croydon, Merstham, and Godstone.	No. 89, at Croydon, to Reigate. Made only to Merstham, 8½ miles from Croydon.	1803	Part 1805	Total 15½	To Godstone proposed, but never made.	Horses	60,000 30,000 90,000	90,000	The line sold to No. 55 company, and closed. Company dissolved in 1839.
24. Deptford Pier Junction.	No. 57, at High Street, Deptford, to the Thames at Deptford Pier.	1836	Not yet made.	783 yards.	To join No. 57	Locom. Engines intended	60,000 20,000 80,000	120,000	For steam-boat passengers to and from the Greenwich Railway.
25. Duffryn-Llynvi & Porth-Cawl.	Duffryn-Llynvi to the Bay of Porth-Cawl, Glamorganshire.	1825	1828	18	Joins No. 11	Horses	40,000 20,000 60,000	110,000	Connects several mines and quarries with the Bristol Channel. Rises 490 feet.

NAME.	COURSE.	Date of Act.	Date of Opening.	Length in Miles.	Branches, &c.	Power used.	Original Capital.	Present Capital.	REMARKS.
26. Durham and Sunderland.	From the City of Durham to the Sea at Sunderland.	1834	1836	16	To collieries, &c. Joins No. 20.	Fixed Engines.	£102,000 in shares.	£256,000	Chiefly for coal; but a few passengers are conveyed. Principally a single track.
27. Durham Junction.	No. 38, near Moorsley, to the Stanhope and Tyne (private) Railway at Usworth.	1834	Aug. 1838	..	To Houghton-le-Spring. Joins No. 38.	Locom. Engines.	80,000 34,000 114,000	130,000	Chiefly for coal, &c.; but a few passengers are conveyed.
28. Eastern Counties.	High Street, Shoreditch, by Colchester, to Norwich and Yarmouth.	1836	Part 1839	126	Joins No. 70. *See* also No. 92.	Locom. Engines.	1,600,000 533,333 2,133,333	..	For passengers and general traffic. Gauge 5 f. 17¼ m. open July, 1840.
29. Festiniog . .	Port-Madoc, Caernarvonshire, to Slate-quarries at Festiniog, Merionethshire.	1832	April, 1836	13½	..	Horses.	24,185 10,000 34,185	50,185	For the conveyance of slates. A tunnel 780 y., being made in 1840. Gauge about 2 f.
30. Forest of Dean (formerly Bullo Pill.)	From the Severn, near Newnham, into the Forest of Dean, Gloucestershire.	1809 1826	—	7½	To collieries, &c. Joins No. 66.	Horses.	125,000 in shares. (Act, 1826).	..	For minerals, &c. The present Company was formed by the Act of 1826.
31. Gloucester and Cheltenham.	From the Berkely Canal Basin at Gloucester, to Cheltenham.	1809	—	9	One, near Cheltenham.	Horses.	25,000 10,000 35,000	50,000	A plate-railway for coal, &c. purchased for 35,000*l*. by the Companies Nos. 4 and 17.
32. Gosport Branch	From No. 58, near Bishopstoke, to Gosport, Hampshire.	1839	In progress.	15¾	Joins No. 58.	Locom. Engines intended	300,000 100,000 400,000	..	For passengers and general traffic. Gauge 4 f. 8½ in. Made by No. 58 Company.
33. Grand Junction	No. 53, at Birmingham, to No. 93, at Warrington, and by it to No. 50.	1833	July, 1837	82¼	Joins Nos. 3, 19, 53, 60, and 93.	Locom. Engines.	1,040,000 346,000 1,386,000	1,957,800 with No. 93.	For passengers and general traffic. Gauge 4 f. 8½ in. United with Nos. 19 & 93.
34. Great North of England.	No. 98, near York, by Darlington, to Redheugh, south side of the Tyne.	1836 1837	In progress.	76 Brs. 2	To York & Durham. Joins 20, 35, 87, & 98.	Locom. Engines intended	1,000,000 150,000 1,150,000	1,330,000	For passengers & general traffic. The line from Darlington to York is by Act 1837.
35. Gt. N. of England, Clarence, & Hartlepool Junctⁿ	From a branch of 38 at Castle Eden, to 20 and 34 at Merrington, Durham.	1837	—	7½ Br. 1¼	To join Nos. 20, 34, and 38.	Locom. Engines intended	52,500 17,500 70,000	..	Intended chiefly for minerals merchandize, &c.
36 Great Western.	From Paddington, by Reading, Wellingford, and Bath, to Temple Mead, Bristol.	1835	Part 1838	117½	To Bradford and Trowbridge. Joins 12, 17, & 95.	Locom. Engines.	2,500,000 833,333 3,333,333	4,999,999 *See* note(*b*)	For passengers and genera. traffic. Gauge 7 f. 75 m. were open in August, 1840.
37. Grosmont . .	No. 52, at Llanvihangel, Monmouthsh., to near Llangua Bridge, Herefordshire.	1812	—	7	Joins Nos. 42 & 52.	Horses.	13,000 7,000 20,000	..	A plate-railway, for coal, merchandize, &c. The line rises 166 f.
38. Hartlepool .	Hartlepool to Moorsley, parish of Houghton-le-Spring, Durham.	1832	1836	15	To Durham, &c. Joins Nos. 27 & 35.	Locom. Engines.	209,000 70,000 279,000	492,000	Chiefly for coal, but some passengers conveyed. Gauge 4 f. 8½ in.
39. Hay . . .	From near Brecon to Parton Cross and Eardisley, Herefordshire.	1811	—	24	Joins No. 45.	Horses.	50,000 15,000 65,000	..	A plate-railway, for minerals, merchandize, &c. The line is very circuitous.
40. Hayle . . .	From the Port of Hayle to Redruth, and to adjacent Mines, Cornwall.	1834	—	12 Br. 3½	To Portreath, &c. &c. Joins No. 78.	Locom. Eng. & incl. pl.	64,000 16,000 80,000	..	Used principally for the conveyance of minerals.
41. Heckbridge & Wentbridge.	Heckbridge, parish of Snaith, to Wentbridge, parish of Kirksmeaton, Yorkshire.	1826	—	7½	..	..	11,300 2,800 14,100	21,700	For the conveyance of stone to the Knottingley and Goole canal.
42. Hereford . .	No. 37, at Monmouth Cap, Llangua, to near the City of Hereford.	1826	1830	12¼	Joins No. 37.	Horses.	23,000 12,000 35,000	.	A plate-railway, in continuation of Nos. 52 and 37, for coal, corn, &c.
43. Hull and Selby	Humber Dock, Hull, to No. 48, at Selby, West Riding of Yorkshire.	1836	July, 1840	30¼	Joins No. 48.	Locom. Engines.	400,000 133,333 533,333	..	For passengers and general traffic. Gauge 4 f. 9 in. Very straight and level.
44. Kenyon and Leigh Junction.	No. 8, at West Leigh, to No. 50, at Kenyon, Lancashire.	1829	—	2½	Joins Nos. 8 & 50.	Locom. Engines.	25,000 6,250 31,250	..	A single track. Worked by the Bolton and Leigh Railway Company.
45. Kington . .	No. 39, at Eardisley, by Kington, to Lime works at Burlinjob, Radnorshire.	1818	—	14	Joins No. 39.	Horses.	18,000 5,000 23,000		For coal, lime, agricultural produce, &c.
46. Lancaster and Preston Junction.	No. 72, at Dock St. Preston, to the town of Lancaster.	1837	June, 1840	20¼	Joins No. 72 and 77.	Locom. Engines.	250,000 83,000 333,000	488,000	For passengers and general traffic. Gauge 4 f. 8½ in.
47. Launceston and Victoria.	Launceston, to an intended Harbour at Tremoutha Haven, Cornwall.	1836	Not yet made.	16¾	..	..	165,000 55,000 220,000	..	Connected with the Duke of Cornwall's Harbour. Not in progress. November, 1840.
48. Leeds and Selby.	Marsh Lane, Leeds, to the Ouse at Selby, West Riding of Yorkshire.	1830	Sept. 1834	20	Joins Nos. 43 and 98.	Locom. Engines.	210,000 90,000 300,000	340,000	For passengers & general traffic. Gauge 4 f. 8½ in. Leased to Nos. 71 & 98, in 1840.
49. Leicester and Swannington.	The River Soar, at Leicester, to Swannington, Leicestershire.	1830	July, 1832	16	To collieries, &c. Joins No. 21.	Chiefly Locom. Engines.	90,000 20,000 110,000	175,000	For coal, lime, passengers, &c. Gauge 4 f. 8½ in. A tunnel 1¼ mile long.
50. Liverpool and Manchester.	From Lime Street and from Wapping, Liverpool, to Water Street, Manchester.	1826	Sept. 1830	31	To collieries, &c. Joins 44, 80, 93, and 97 (*c*).	Locom. Eng. 3 incl. pl.	510,000 127,500 637,500	1,832,375 *See* note(*c*).	For passengers and general traffic. Gauge 4 f. 8½ in. *See* note (*c*).

(*b*) In addition to the parliamentary capital of 4,999,999*l*., the directors have been authorised to raise 600,000*l*. on loan notes.

(*c*) An Act passed in 1839 empowers the Company to raise 208,000*l*. for making a branch of about a mile long, to connect with the Manchester and Leeds and

NAME.	COURSE.	Date of Act.	Date of Opening.	Length in Miles.	Branches, &c.	Power used.	Original Capital.	Present Capital.	REMARKS.
51. Llanelly . .	From Docks at Llanelly to Llandibie, Caermarthenshire.	1828 1835	Part 1833	Total 26	Many, to collieries, &c.	Locom. Engines.	£14,000 6,000 20,000	£270,000	For minerals, &c. Gauge 4f. 8½ in. Greater part of the line made under Act of 1835.
52. Llanvihangel .	From near Abergavenny to Llanvihangel Crucorney, Monmouthshire.	1811	—	6½	Joins No. 37.	Horses.	20,000 15,000 35,000	..	A plate-railway, for minerals, &c. Joins the Brecknock & Abergavenny canal.
53. London & Birmingham.	Euston Grove, London, to Nova Scotia Gardens, Birmingham.	1833	Sept. 1838	112	Joins Nos. 2, 3, 4, 33, 65, and 95. *See* also 59.	Locom. Eng. One incl. pl.	2,500,000 835,000 3,335,000	5,500,000 *See* note (*d*)	For passengers and general traffic. Gauge 4 f. 8½ in.
54. London & Blackwall (formerly Commercial)	Fenchurch Street, City of London, to Brunswick Wharf, Blackwall.	1836	Part 1840	3½	To the East and West India Docks.	Fixed Engines.	600,000 200,000 800,000	..	For passengers and general traffic. Gauge 5 f. 0½ in. Chiefly on a brick viaduct.
55. London and Brighton.	No. 56, near Croydon, passing east of Reigate and Cuckfield, to Brighton.	1837	Part 1840	41½ Brs. 19½	To Shoreham, Lewes, and Newhaven. *See* 56 and 86.	Locom. Engines.	1,800,000 600,000 2,400,000	..	For passengers and general traffic. Gauge 4 f. 8½ in. The Compy. have bought No 23.
56. London & Croydon.	From No. 57, 1¾m. from London Bridge, to Croydon, Surrey.	1835	June, 1839	8½	Joins Nos. 55 & 57.	Locom. Engines.	140,000 45,000 185,000	741,000	For passengers and general traffic. Gauge 4 f. 8½ in.
57. London and Greenwich.	Tooley Street, south end of London Bridge, to Greenwich.	1833	Dec. 1838.	3¾	Joins No. 56. *See* also No. 24.	Locom. Engines.	400,000 133,000 533,000	993,000	Chiefly for passengers. Gauge 4 f. 8½ in. Constructed entirely on arches.
58. London & South Western (formerly Southampton).	Nine Elms, Vauxhall, London, to near the Docks, Southampton.	1834	May, 1840	76½	Joins No. 32.	Locom. Engines.	1,000,000 330,000 1,330,000	1,860,000	For passengers and general traffic. Gauge 4 f. 8½ in.
59. London Grand Junction.	Skinner Street, City of London, to No. 53, at Camden Town.	1836	Not yet made.	2½	Intended to join No 53.	Locom. Engines allowed.	600,000 200,000 800,000	..	For passengers, &c. Commenced, but not in progress (1840). Act has expired.
60. Manchester & Birmingham.	Store Street, Manchester, by Stockport, &c., to No. 33, at Chebsey, Staffordshire.	1837	Part 1840	45½ Brs. 26½	To Crewe & Macclesfield. Joins 19, 33, & 83.	Locom. Engines.	2,100,000 700,000 2,800,000	..	For passengers and general traffic. Gauge 4 f. 8½ in *See* note (*e*).
61. Manchester & Bolton.	Irwell St., Manchester, nearly parallel with the canal, to Bolton.	1831	May, 1838	10	Joins Nos. 8 & 9. *See* also note (*c*) p. 263.	Locom. Engines.	204,000	650,000	For passengers and general traffic. Gauge 4 f. 8½ in Made by the Canal Compy.
62. Manchester & Leeds.	Hunt's Bank, Manchester, to No. 71, at Normanton, near Wakefield.	1836	Part 1839	50½ Brs. 5½	To Oldham, Halifax, &c. Joins 71. *See*(*c*) p. 263.	Locom. Eng. inc. pl. on brs.	1,300,000 433,000 1,733,000	2,599,000	For passengers and general traffic. Gauge 4 f. 9 in.; 41 miles open, October, 1840.
63. Mansfield and Pinxton.	Mansfield, Notts., to the Cromford Canal at Pinxton, Derbyshire.	1817	—	7½ Br. 1½	To Codnor Park Iron Works.	Horses.	22,800 10,000 32,800	..	Chiefly used for coal, &c. Average inclination about 50 feet per mile.
64. Maryport and Carlisle.	Harbour of Maryport, Cumberland, to No. 68, at Carlisle.	1837	Part 1840	28	Joins No. 68	Locom. Engines.	180,000 60,000 240,000	..	For passengers and general traffic. 7½ m. opened July, 1840, chiefly for coal.
65. Midland Counties.	No. 53, at Rugby, by Leicester, to Nottingham, and also to Derby.	1836	June, 1840	57 Br. 1	To Mountsorrel. Joins Nos. 3, 53, and 71.	Locom. Engines	1,000,000 333,000 1,333,000	1,533,000	For passeng. & general traffic. Gauge 4 f. 9 in. Rugby to Derby 49 m.; to Nott. 47½ m.
66. Monmouth. .	The "Thatched Pit," Forest of Dean, Gloucestershire, to Monmouth.	1810	1817	Total 8	To quarries, collieries, &c. Joins 30 and 82.	Horses.	22,000 6,000 28,000	..	For the conveyance of minerals, timber, &c., from the Forest of Dean.
67. Nantlle . . .	Slate-quarries at Nantlle pool to the port of Caernarvon.	1825	1828	9½	..	Horses.	20,000 in shares.	40,000	For the conveyance of slates.
68. Newcastle-upon-Tyne and Carlisle	Newcastle, by Hexham and Haltwhistle, to the canal basin, Carlisle.	1829	1839	61	To Redheugh. *See* No. 6. Joins 10 & 64.	Locom. Engines.	300,000 100,000 400,000	950,000	For passengers and general traffic. Gauge 4 f. 8½ inch. Partly opened in 1835.
69. Newcastle-upon-Tyne and North Shields.	Pilgrim Street, Newcastle, to the town of North Shields.	1836	June, 1839	6½	To the New Quay, North Shields.	Locom. Engines.	120,000 40,000 160,000	320,000	Chiefly for passengers. An extension to Tynemouth is proposed.
70. Northern and Eastern.	No. 28, at Angel Lane, Stratford, to Bishop's Stortford, Hertfordshire.	1836	Part 1840	30	Joins No. 28.	Locom. Engines.	1,200,000 400,000 1,600,000	720,000 240,000 960,000	For passengers and general traffic. Gauge 5 f. Projected to go to Cambridge, 53 m.
71. North Midland	Nos. 3 and 65, at Derby, to Hunslet Lane, Leeds.	1836	July, 1840	72½ Br. 2½	To a colliery. Joins 3, 62, 65, 84, and 98.	Locom. Engines.	1,500,000 500,000 2,000,000	3,000,000	For passengers and general traffic. Gauge 4 f. 9 in.
72. North Union (formerly Preston & Wigan).	From No. 50, by Wigan, (see No. 97,) to Dock Street, Preston.	1831	Oct., 1838	22½ Br. 3	To New Springs. Joins 9, 46, & 50. *See* 97.	Locom. Engines.	250,000 83,000 333,000	730,000 with No. 97.	For passengers and general traffic. Gauge 4 f. 8½ in. United with 97 in 1834.
73. Oystermouth .	Swansea, along the coast, to Oystermouth, Glamorganshire.	1804	—	7½	To mines, &c.	Horses.	8,000 4,000 12,000	..	Chiefly for minerals. A few passengers conveyed.
74. Plymouth and Dartmoor.	Plymouth to the prison of war on Dartmoor, Devonshire.	1819	—	Total 25½	One, to Catdown & Sutton Pool.	Horses.	27,783 5,000 32,783	44,983	For minerals, &c. The line is very circuitous.
75. Portland . .	The Priory Lands to near Portland Castle, Isle of Portland.	1825	—	2	..	Fixed Engines.	5,000 2,000 7,000	..	A plate-railway, for the conveyance of Portland stone for shipment.
76. Preston & Longridge.	From near St. Paul's Square, Preston, to Longridge Fell, Lancashire.	1836	May, 1840	7	..	Horses.	30,000 10,000 40,000	..	For the conveyance of Longridge stone, heavy goods, &c. A single track.

NAME.	COURSE.	Date of Act.	Date of Opening.	Length in Miles.	Branches, &c.	Power used.	Original Capital.	Present Capital.	REMARKS.
77. Preston and Wyre.	No. 46, at Preston, to Fleetwood on Wyre, Lancashire.	1835	July, 1840	19¼	Joins No. 46.	Locom. Engines.	£130,000 40,000 170,000	£400,000	For passengers and general traffic. Chiefly a single track. Gauge 4 f. 8½ in.
78. Redruth and Chasewater (or Deveron).	Redruth to Point Quay, Restrongett Creek, Cornwall.	1824	—	14	To mines, &c. Joins No. 40.	Horses	22,500 10,000 32,500	..	For minerals, merchandize, &c.
79. Rumney . .	Rumney Ironworks to No. 85 at Bassaleg, Monmouthshire	1825	—	21¼	Joins No. 85.	Horses	47,100 20,000 67,100	..	A plate-railway for minerals, &c.; runs parallel with the river Rumney.
80. St. Helen's and Runcorn Gap.	Cowley Hill Colliery, St. Helen's, to Runcorn Gap, on the Mersey.	1830	—	Total 12	To collieries, &c. Joins No. 50.	Locom. and fixed Engines.	120,000 30,000 150,000	220,000	Chiefly for coal, but a few passengers conveyed. Gauge, 4 ft. 8½ in.
81. Saundersfoot .	Thomas Chapel Mountain to Saundersfoot Harbour, Pembrokeshire.	1829	—	..	Short Branches	..	17,500 8,000 25,500	..	For coal, &c. The Act provides for the improvement of the harbour.
82. Severn & Wye	From the Severn, near Lydney, to the Wye, near Ruardean, Gloucestershire.	1809	—	Total 26	Several, to collieries &c.—Joins No. 66.	Horses	35,000 20,000 55,000	115,000	For the conveyance of minerals, timber, &c., from the Forest of Dean.
83. Sheffield, Ashton-under-Lyne, and Manchester	Spital Fields Sheffield, by Penistone, &c., to No. 60, at Manchester.	1837	In progress.	40	Joins No. 60	Locom. Engines intended	700,000 233,000 933,000	..	For passengers and general traffic. A tunnel 3 m. long, 16 ft. wide, for one track.
84. Sheffield and Rotherham .	From Brightside, Sheffield, to near West Gate, Rotherham.	1836	Oct. 1838	5¼ Br. 1¼	To Greasborough Joins No. 71.	Locom. Engines	160,000 30,000 190,000	200,000	For passengers, coal, and general traffic. Gauge, 4 ft. 8½ in.
85. Sirhowey . .	From near Newport, Monmouthshire, to Tredegar and Sirhowey ironworks, &c.	1802	—	Total 28	To Trevill (with edge-rails), &c. Joins No. 79.	Locom. Eng. and Horses.	30,000 15,000 45,000	..	Chiefly a plate-railway, for iron, coal, &c. Joins the Monmouthshire Canal.
86. South-Eastern	No. 55, at Redhill, 20 m. from London, by Tunbridge and Ashford to Dover.	1836	In progress.	66	Joins No. 55	Locom. Engines intended	1,400,000 450,000 1,850,000	..	For passengers and general traffic. Formerly intended to commence at Croydon.
87. Stockton and Darlington.	From Stockton, by Darlington, to Witton Park Colliery, Durham.	1821	Sept. 1825	Total 54 (*f*)	To Middlesbrough, &c. &c. Joins 5, 20, & 31.	Chiefly Locom. Engines.	82,000 20,000 102,000	150,000 *See* note (*f*).	For coal, merchandize, and passengers. Gauge, 4 ft. 8½ in. Principally a double line.
88. Stratford and Moreton.	Stratford on Avon, Warwickshire, to Moreton in Marsh, Gloucestershire.	1821	1826	16 Br 2¼	To Shipston-on-Stour.	Horses	33,500 7,000 40,500	77,149	For coal, corn, &c. A few passengers conveyed. A single track.
89. Surrey . .	From the Thames at Wandsworth to Croydon, Surrey.	1801	1805	9½ Br. 1¼	To Carshalton, &c. Joins No. 23.	Horses	35,000 15,000 50,000	60,000	A plate-railway for coal, lime &c. Gauge, 4 ft. Ordinary inclination, 1 in 120.
90. Taff Vale . .	Merthyr Tydvil to the Port of Cardiff, Glamorganshire .	1836	Part 1840	24½ Brs. 17	Several, to mines, &c.	Locom. Engines.	300,000 100,000 400,000	620,000	For minerals, merchandize, and passengers. 14 miles opened Oct. 1840.
91. Taw Vale . .	Barnstaple to an intended Dock at Fremington, Devonshire.	1838	In progress	2¼	..	Locom. Engines allowed.	15,000 5,000 20,000	..	For passengers, merchandize, &c. A tunnel 418 yards long, for one track.
92. Thames Haven	No. 28, at Romford, to the Thames, at Shell Haven, Essex.	1836	Not yet made.	15¼	Intended to join No. 28.	Locom. Engines intended.	450,000 150,000 600,000	..	For coal, merchandize, and passengers. The Company to form docks at Shell Haven.
93. Warrington & Newton . .	Warrington to No. 50 at two points, at Newton, Lancashire.	1829	1831	4½	Joins Nos. 33 & 50.	Locom. Engines.	57,000 20,000 77,000	93,000	For passengers and general traffic. Gauge, 4 ft. 8½ in. United in 1835 to No. 33.
94. West Durham.	Byer's Green branch of No. 20, to Crook and Billy Row, Durham.	1839	Part 1840	5¼	Joins No. 20	Locom. Eng. One incl. pl.	33,923 11,307 45,230	..	Chiefly for minerals. Commenced before the Act was obtained.
95. West London, formerly Birm., Bris & Thames Junc.	Nos. 36 and 53, near Holsden Green, to the Canal at Kensington.	1836	In progress.	3	Joins Nos. 56 & 53.	Uncertⁿ. Locom. allowed.	150,000 50,000 200,000	280,000	To connect 36 and 53 with the Thames, by means of the Kensington Canal.
96. Whitby & Pickering.	Harbour of Whitby to Pickering, North Riding of Yorkshire.	1833	May, 1836	24	To Whitby Stone Quarries.	Horses, and two incl. pl.	80,000 25,000 105,000	135,000	For passengers and general traffic. A single track. Gauge, 4 ft. 8½ in.
97. Wigan Branch	No. 50, at Parkside, to the Town of Wigan, Lancashire.	1830	Sept. 1832	7 Br. 3	To New Springs. Joins No. 50: *see* also 72.	Locom. Engines.	70,000 17,500 87,500	..	For passengers and general traffic. Gauge, 4 ft. 8½ in. United in 1834 with No. 72.
98. York & North Midland.	Tanner Row, City of York, to No. 71, at Altofts, West Riding of Yorkshire.	1836	June, 1840	23¼ Brs. 4	Branches to Nos. 48 & 71. Joins also 34.	Locom. Engines.	370,000 123,333 493,333	335,000 111,666 446,666	For passengers & general traffic. Gauge, 4 ft. 9 in. Capital reduced by Act of 1837.

RAILWAYS OF SCOTLAND.

NAME.	COURSE.	Date of Act.	Date of Opening.	Length in Miles.	Branches, &c.	Power used.	Original Capital.	Present Capital.	REMARKS.
99. Arbroath and Forfar.	No. 102, at Arbroath Harbour, to Forfar.	1836	Jan. 1839	15¼	Joins No. 102	Locom. Engines.	70,000 35,000 105,000	160,000	For passengers and general traffic. A single track. Gauge, 5 ft. 6 in.
100. Ardrossan, formerly Johnstone and Ardrossan.	Ardrossan Harbour to Kilwinning, Ayrshire; projected to extend to Johnstone.	1827	Part —	(*g*) 5¼ Brs. 6¼	Two Branches. Joins 109.	Chiefly Locom. Engines.	95,658 in shares.	106,666	For coal, passengers, &c. Gauge, 4 ft. 8½ in.

(*f*) The main line from Witton Park Colliery to Stockton, is 28, or to Middlesbrough, 32 miles; and the total length of the lines specified in the Acts of Parliament is about 40 miles. It appears, however, by a letter from the Chairman to the Irish Railway Commissioners, that the Company have formed 54 miles of railway, of which 28 has a double track. The sum of 450,000*l.* is stated in the same document to have been expended, though the total *Parliamentary* capital is only 252,000*l.*

NAME.	COURSE.	Date of Act.	Date of Opening.	Length in Miles	Branches, &c.	Power used.	Original Capital.	Present Capital.	REMARKS.
101. Ballochney	Arbuckle and Ballochney to No. 111, at Kipplyres, Lanarkshire.	1826	1828	4½ Brs. 2	Several, to collieries. Joins 111 and 116.	Chiefly Locom. Engines	£18,425 10,000 28,425	£93,333	For coal, ironstone, &c. Some passengers conveyed. Gauge 4 ft. 8½ in.
102. Dundee and Arbroath.	Trades Lane, Dundee, by the coast, to No. 99, at Arbroath Harbour.	1836	April, 1840	16¾	Joins No. 99	Locom. Engines	100,000 40,000 140,000	..	For passengers and general traffic. Gauge, 5 ft. 6 in. Part opened in 1838.
103. Dundee and Newtyle.	North side of Dundee to Newtyle, county of Forfar.	1826	Dec. 1831	10½	Joins Nos. 112 and 113.	Locom. & fixed Engines	30,000 10,000 40,000	170,000	For passengers and general traffic. A single track. The line rises 514 feet.
104. Edinburgh and Dalkeith.	Edinburgh, by Dalkeith, to the South Esk, near Newbattle.	1826	1831	Total 15	To Leith, Fisherrow, &c.	Horses.	70,125 20,000 90,125	208,753	For coal, merchandize, and passengers. Chiefly a single track.
105. Edinburgh and Glasgow.	The Haymarket, Edinburgh, to North Queen Street, Glasgow.	1838	In progress.	46 Br. 1	To Falkirk, for horse power.	Locom. Engines intended	900,000 300,000 1,200,000	..	For passengers and general traffic. Gauge, 4 ft. 8½ in.
106. Edinburgh, Leith, and Newhaven.	Princes Street, Edinburgh, to Trinity Harbour.	1836	In progress.	2¼	To Leith, abandoned by Act of 1839.	Fixed Engines intended	100,000 40,000 140,000	..	For passengers, goods, &c. A tunnel 1000 yards long, 12 ft. wide, and 16 ft. high.
107. Garnkirk and Glasgow.	No. 111, at Cargill Colliery, by Garnkirk, to Glasgow.	1826	1831	8¼	Joins No. 111.	Chiefly Locom. Engines.	28,497 10,000 38,497	169,195	For the conveyance of coal, passengers, &c. Gauge, 4 ft. 8½ in.
108. Glasgow, Paisley, and Greenock.	Near Glasgow Bridge, Glasgow, through Paisley, to Greenock.	1837	Part 1840	*22½	To quays, &c. Joins No. 109.	Locom. Engines.	400,000 133,333 533,333	..	For passengers and general traffic. Gauge, 4 ft. 8½ in. *6½ m. joint line with 109
109. Glasgow, Paisley, Kilmarnock, and Ayr.	Glasgow to Paisley, by No. 108, and thence by Kilwinning to Ayr.	1837	Part 1840	*40 Brs. 17½	To Kilmarnock, &c. Joins 100, 108, and 110.	Locom. Engines.	625,000 208,000 833,000	..	For passengers and general traffic. Gauge, 4 ft. 8½ in. * 6½ m. joint line with 108.
110. Kilmarnock and Troon.	Kilmarnock to the Harbour of Troon, Ayrshire.	1808	—	9½	Joins No. 109.	Horses.	40,000 15,000 55,000	95,000 See note (*h*).	A plate railway for coal, lime &c. Very few passengers. Gauge 4 ft. See note (*h*).
111. Monkland and Kirkintilloch.	Palace Craig, Old Monkland, Lanarkshire, to near Kirkintilloch.	1824	1826	12	To collieries, &c. Joins 101, 107, and 117.	Locom. Engines.	32,000 10,000 42,000	201,000	For coal, &c. A few passengers conveyed. Joins the Forth and Clyde canal.
112. Newtyle and Coupar Angus.	No. 103 at Newtyle, to Coupar Angus, Forfarshire.	1835	Feb. 1837	5¼	Joins Nos. 103 and 113.	Horses.	15,200 5,000 20,200	40,200	For passengers and general traffic. Worked by No. 103 company.
113. Newtyle and Glammiss.	Nos. 103 and 112 at Newtyle, to Glammiss, Forfarshire.	1835	—	..	Joins Nos. 103 and 112.	..	20,000 6,600 26,600	..	For passengers and general traffic.
114. Paisley and Renfrew.	Paisley to the River Clyde at Renfrew Ferry.	1835	April 1837	3½	..	Locom. Engines.	23,000 10,000 33,000	..	For passengers to steam boats, &c., and general traffic.
115. Polloc and Govan.	Collieries at Polloc and Govan to the Clyde at Broomielaw.	1830	—	..	To Rutherglen, &c.	..	10,000 5,000 15,000	66,000	For the conveyance of coal, &c. Gauge 4 ft. 8½ in.
116. Slamannan.	No. 101 at New Monkland, to the Union Canal near Linlithgow.	1835	1840	12½ Br. 4½	To Bathgate, &c. Joins No. 101.	Locom. Engines.	86,000 20,000 106,000	186,666	Chiefly for minerals. A few passengers. Partly a single line. Gauge 4 ft. 8½ in.
117. Wishaw and Coltness.	No. 111 at Old Monkland, to Chapel, parish of Cambusnethan, Lanarkshire.	1829	6¼m. open.	13	To collieries. Joins No. 111.	Chiefly Locom. Engines.	60,000 20,000 80,000	160,000	For minerals, &c. Part still in progress. Gauge 4ft. 8½ in.

RAILWAYS OF IRELAND.

NAME.	COURSE.	Date of Act.	Date of Opening.	Length in Miles	Branches, &c.	Power used.	Original Capital.	Present Capital.	REMARKS.
118. Belfast and Cavehill.	Stone Quarries at Cavehill, to Belfast Harbour.	1832	Sept. 1840	2	..	Locom. Engines allowed.	£7,500 2,500 10,000	£38,200	For the conveyance of stone, &c. Gauge 4 f. 8½ in.
119. Cork and Passage.	City of Cork, to Passage, entrance of Cork Harbour.	1837	..	6½	..	Locom. Engines allowed.	200,000 66,000 266,000	..	To convey passengers to a steam-packet pier. Not in progress, November, 1840.
120. Dublin and Drogheda.	Custom-House Quay, Dublin, near the Coast, to Drogheda.	1836	In progress.	32	..	Locom. Engines intended	600,000 200,000 800,000	450,000 150,000 600,000	For passengers and general traffic. Capital reduced by an Act passed 1840.
121. Dublin and Kingstown.	Westland-row, Dublin, to Kingstown Harbour.	1831	Dec. 1834	5¾	..	Locom. Engines.	200,000 70,000 270,000	..	For passengers and general traffic. Gauge 4 f. 8½ in.
122. Dundalk Western.	Dundalk, county of Louth, to Ballaby, county of Monaghan.	1837	..	24	..	Horses intended	100,000 32,000 132,000	..	For passengers and general traffic. Works commenced in May, 1839.
123. Great Leinster and Munster.	Dublin, by Naas, Athy, and Carlow, to Kilkenny	1837	In progress.	73½	..	Locom. Engines intended	800,000 265,000 1,0 5,000	..	For passengers and general traffic. The land required agreed for in 1840.
124. Ulster.	From near Durham Street, Belfast, by Lisburn and Portadown, to Armagh.	1836	Part 1839	36	..	Locom. Engines.	600,000 200,000 800,000	..	For passengers and general traffic. 8 miles open, and a further portion in progress.

[illegible] have been carried into effect, allows the raising of 40,000*l*. by new shares, for converting this line

AMERICAN RAILWAYS.

The first railway constructed in the United States of America was a line of about four miles, for the conveyance of granite from the quarries at Quincy to Boston harbour, which was opened in 1827. The successful introduction of steam locomotion in England was immediately followed by the formation of numerous important lines of railroad in America, and this species of enterprise has been so greatly encouraged, that, according to a statement published by the Chevalier de Gerstner (an engineer celebrated for the promotion of railways on the continent of Europe), the railroads completed in the United States, down to the summer of 1839, amounted to more than 3000 miles; while the extent of those in progress warranted an expectation that about 4100 miles would be in operation by the close of that year. In many cases the country over which these lines have been made is favourable in a degree unparalleled in this country; and, owing to the cheapness of land and timber, the great facilities offered by the various states, and the comparatively slight construction of many lines, their average cost has been greatly below that of English railways. Stevenson, in his 'Civil Engineering of North America,' states the average of several lines to be about 4942*l.* per mile, a statement which appears to be borne out by the more recent calculation of Gerstner. Many lines are laid with but one track, and the gradients and curves are often less favourable than those of the public lines in this country, the thin population of the districts passed through, and the high price of labour, precluding much expense in cuttings and embankments. Timber is used extensively in the construction of the permanent way, on account of the facility of working it, and the expense of stone and iron. Stone blocks have been found in some instances to split from the effect of the intense frost, which forms an additional reason for the preference given to wood. The gauge most commonly adopted is four feet eight inches and a half, this width having been taken from the English lines. American locomotive engines do not usually travel so fast as those made by British manufacturers, but they are frequently adapted for ascending steep inclined planes, and, as described in a previous page, for traversing curves of small radius. The carriages used are very large and commodious, some being as much as fifty or sixty feet long, mounted on eight wheels, and so arranged that passengers may walk from one end of the train to the other.

According to Stevenson, the only railway in the British dominions in North America, down to the year 1837, was the Champlain and St. Lawrence line, which was formed under an Act passed in 1832. It is about sixteen miles long, and is worked by locomotive engines.

A railway of between forty and fifty miles, for the conveyance of passengers and goods by locomotive engines, has been made in the island of Cuba, between Havana and Guines. The rails, engines, carriages, &c. were made in England.

CONTINENTAL RAILWAYS.

The first railway laid down in France was a short line formed in 1783, at Mont Cenis, for the use of the foundries of Creusot. In 1828 a line of about twelve miles was completed between St. Etienne and Andrezieux, and others uniting it with Lyon and Roanne have since that time been brought into operation, partly worked by locomotives and partly by horses. Though useful, they have not proved remunerative. Preliminary measures have been taken for several important lines, but comparatively little has been done in their formation. Railways are open from Paris to Versailles and St. Germain, and a second line to Versailles and one to Orleans are in progress. The Paris and Rouen railway, which will probably be extended to Hâvre, is about to be formed by a company composed of French and English capitalists.

In Belgium a comprehensive system of railways is in course of execution by the government. The scheme was sanctioned by the legislature in 1834, and the first section of railway was opened in the following year. The aggregate length of the lines comprised in the original plan was nearly 250 miles; but subsequent additions have increased the total length to upwards of 400 miles, of which 258 miles were in use in March, 1840, and the remainder was expected to be complete within two years of that time. Of the lines then completed, about three-fourths have but a single track, and the country being generally flat, the expense has been small in comparison with the railways of England, not having exceeded 10,000*l.* per mile, including engines and carriages. The average speed is equal to that on the English lines, and the amount of travelling has been very great, although the returns are small, the object of the government being rather to provide accommodation at the lowest possible charge, than to make the railways a source of revenue. The main line from west to east extends from the port of Ostend to Liege, and thence to the Prussian frontier, to join the railway to Cologne. Another line commences at Antwerp, and, intersecting the former at Malines, proceeds to Brussels and Mons, whence it is to extend to the frontier of France. Branches connect Namur, St. Trond, Courtrai, Tournay, &c. with the main lines, and afford facilities for communication with the projected lines of the neighbouring countries.

In Germany a railway of about 130 English miles, between Budweis, Linz, and Gmünden, has been in operation several years, part having been opened as early as 1829. It is worked by horses, and used chiefly for the carriage of merchandise. Other lines of great extent, generally for the use of locomotive engines, are in progress, and considerable portions are in successful operation. The Austrian government has afforded great encouragement to these undertakings, which will shortly connect Vienna with the surrounding countries. Important railways are also in progress in Italy and other parts of the continent of Europe.

In Russia an interesting line of about seventeen English miles, connecting St. Petersburg with the towns and royal parks of Pawlowsk and Zarseoe-Selo, was completed in 1837. It is worked by locomotive engines, and is traversed by a great number of passengers. The line has but one track, six feet wide, and was formed by a joint-stock company under imperial sanction. It is intended to continue the line to Moscow, about 420 miles from St. Petersburg, and some other extensive railways are in contemplation.

Railways have been introduced into Egypt, and projected in India and several other parts of the world, the engineers being frequently and the machinery almost invariably from England.

RAIMONDI, MARC ANTONIO, commonly called by his baptismal names Marc Antonio only, was born at Bologna about the year 1487 or 1488. He was instructed in the art of design by Francesco Maria Raibolini, known as Francesco Francia, but having seen some prints by Albert Dürer, he determined on adopting engraving as a profession. It does not appear by whom he was instructed in that art, though most probably it was by some goldsmith, for his first essays with the graver were the embellishment of silver ornaments worn at that period, a circumstance that seems to have led M. Ponce, in the 'Biographie Universelle,' to state that Marc Antonio was originally intended for that business. One of his earliest engravings on copper was a plate from a picture by Francia, representing Pyramus and Thisbe, dated 1502, and executed, with some others, it is supposed, after the same artist, before Raimondi's departure from Bologna At Venice, whither he removed, he purchased, with all the money he had taken with him from home, a set of thirty-six prints engraved on wood by Albert Dürer, representing the Life and Passion of our Saviour. Charmed with the correctness of the design and the precision of the execution, he imitated them on copper, according to Vasari, with such exactness, that they sold in Italy for the originals. The same authority states that Dürer, having seen one of them at Nürnberg, complained to the senate at Venice of the fraud that had been practised, and that Marc Antonio was forbidden to use his signature, which was the only redress he could obtain. It seems that Vasari must have fallen into an error in this story, and mistaken the Life of our Saviour for the Life of the Virgin, as Marc Antonio copied both sets from the cuts of Albert Dürer, to the latter and not to the former of which he affixed the mark of that great artist. M. Heinecken also points out that, besides the tablet which Dürer used as his mark, Marc Antonio added within it his own initials joined, and that he also used the tablet without any mark at all. Indeed there seems altogether very little probability in the story told by Vasari. Persons acquainted with the subject of engravers' monograms are aware that the tablet of the peculiar form adopted by these two great rivals, namely, an oblong square with a small arched piece on the centre portion of the top, was a favourite mark of many artists, as may be seen on the works of Van Assen, Dolendo, Krugen, Saelert, and Voghter. After quitting

Venice, he proceeded to Rome, where he was soon noticed by Raffaelle, who employed him in engraving from his designs, and, it is said, in some instances even traced the outlines on the plates, that the correctness of the drawing might be more perfectly preserved. His first plate after Raffaelle was the Death of Lucretia, which is neatly engraved, but is not one of his best works. His next print, after the same master, was a Judgment of Paris, executed in a more bold and spirited style. These were followed by many more, and amongst them the Murder of the Innocents, after Raffaelle, who was so perfectly satisfied with the efforts of the engraver, that he sent many specimens of his works as complimentary presents to Albert Dürer himself, by whom they were thought well worthy of acceptance.

After the death of Raffaelle, which occurred in 1520, Giulio Romano engaged Marc Antonio to engrave from his designs. Amongst these works are a set of disgusting plates of subjects for which Aretino composed the verses, and which so greatly excited the indignation of Pope Clement VII., that he ordered the engraver to be thrown into prison, from which he was only released at the earnest intercession of some of the cardinals and of Baccio Bandinelli. Moved by gratitude for the services of Bandinelli, Marc Antonio engraved his celebrated print of the Martyrdom of St. Lawrence from a picture by him, which, besides greatly conducing to the engraver's high reputation, procured him not only the entire pardon of the pope, but his active protection and support. On the sacking of Rome by the Spaniards, in 1527, he was obliged to fly, having lost all he had acquired by his art. He returned to his native place, where he continued to engrave until the year 1539, which is the date affixed to his last plate, representing the Battle of the Lapithæ, after Giulio Romano. He is said by Malvasia to have been assassinated by a Roman nobleman for having, contrary to his engagement, engraved a second plate of the Murder of the Innocents, from the design of Raffaelle.

This engraver may be considered one of the most eminent artists in that branch that has ever appeared. His outlines are pure; the character and expression of his heads beautiful; whilst the exact and correct drawing of his works, particularly in the extremities of his figures, evidence that he was in all respects a complete master both of drawing and design. He was one of the first Italian engravers of distinction. The high reputation of Raffaelle, and the happy chance which conduced to the engagement of Marc Antonio as the engraver of his chief works, contribute as well to his reputation as to the high value which is ever set upon his engravings, and the great price they always obtain. Berghem paid sixty florins for an impression of his Murder of the Innocents; and one of Saint Cecilia was sold at the sale of St. Yves for six hundred and nineteen francs. M. Ponce has given the date of his death as 1546; but M. Heinecken seems to consider that the date upon the Battle of the Lapithæ was about the period at which he ceased to work. Some of his prints are marked with an A. and an M. joined, and others with M. A. F. also joined, the F. being used in consequence of the cognomen La Francia having been given to him from his successful study under Raibolini; and some are marked with the tablet mentioned by M. Heinecken.

The works of Marc Antonio are exceedingly numerous. A very copious catalogue of them is given in the work of the last-named author, which extends to a hundred and twenty-five pages. Mr. Bryan observes, that in the prints of this eminent artist great attention should be paid to the different impressions of the plates, which have been greatly retouched and altered by the different printsellers through whose hands they have passed. The best impressions are without the name of any publisher. After the plates were taken from the stock of Tommaso Barlacchi, they came into the possession of Antonio Salamanca; afterwards they passed through the hands of Antonio Laferri, from thence to Nicholas van Aelst, and lastly became the property of Rossi, or De Rubeis, at a time when they were nearly worn out.

In the Print Room of the British Museum there is a very fine collection of the works of Marc Antonio. They amount to about five hundred, the whole of his labours enumerated by Bartsch being six hundred and fifty-two; but it must be recollected that the works of two of his principal pupils, Agostino Veneziano and Marco da Ravenna, are counted with them. Amongst those of the greatest rarity are the Transgression of Adam and Eve; David cutting off the head of Goliah, before the monogram of Marc Antonio was added, a copy of which produced 45*l.* at the sale of the late Sir M. M. Sykes, Bart., in 1824; the Madonna lamenting over the dead body of Christ, called 'La Vierge au bras nud,' from the circumstance of having one arm naked, a print of much value, a copy of which fetched at the same sale 25*l.*, whereas the other print of the same subject, which has the arm draped, engraved also by Marc Antonio, produced only 2*l.*; the Massacre of the Innocents, with the chicot-tree; the Martyrdom of St. Lawrence, a subject mentioned above, a first impression with the two forks, of the estimated value of a hundred guineas, a very inferior copy of which, as to condition, produced at the above sale 46*l.*; the Pest, a proof taken before the letters were engraved, of which only three copies are known to exist; and the Dance of Cupids, a small plate, which, if in good condition, is valued at 60*l.*, a copy of which sold at the sale before alluded to for 57*l.*

There does not appear to be any certainty as to the exact time of the birth of Marc Antonio. M. Heinecken observes that Vasari alone has given us any notice of him. Borghini, Malvasia, and Baldinucci, as well as all the later writers, draw from Vasari all that they say. None of them mention either the year of his birth or death. If however the piece representing Apollo and Hyacinth was engraved by him in 1506, at the age of nineteen years, as the signature would seem to indicate, for the nine only is legible in the impression in the Imperial collection at Vienna, we may infer that he was born at Bologna in 1487 or 1488. (Heinecken, *Dict. des Artistes*; *Biographie Universelle*; Strutt's and Bryan's *Dictionaries*: Bartsch, *Le Peintre Graveur*.)

RAIN. The antients appear to have been very imperfectly acquainted with the constitution of the atmosphere: and Descartes is probably the first who, in attempting to refer meteorological phenomena to their causes, has approached near the hypotheses now generally received: for he ascribes the formation of clouds, snow, rain, and hail to variations of temperature in the upper regions of the air. He supposes that when the coldness in any portion of those regions becomes intense, the subtle matter disseminated among the particles of vapour becoming too weak to keep those particles at a distance from one another, the latter must rush together, and either form small spicular filaments or spherical drops of ice. The superficies of these filaments or drops being supposed to be considerable when compared with their volumes, he conceives that the resistance of the air may be great enough to prevent them from descending by their weight, and that thus a great assemblage of them may remain suspended in the form of a cloud above the earth. The filaments becoming by an accession of heat partially liquefied, it may happen that many of them will adhere together, and thus form flakes of snow, which, at length acquiring sufficient weight to overcome the resistance of the air, descend to the ground. In order to explain the origin of rain and hail, he supposes that the flakes, on arriving near the surface of the earth, may pass through a warmer region than that in which they were formed, and there dissolving, they assume the figure of spherical or spheroidal drops of water. Again, if in the descent the latter should meet a current of cold air, they become globules of ice. (*Meteora*, cap. v., vi.)

The diffusion of the electric fluid through the earth and atmosphere has led some meteorologists to believe that the variations in its quantity or intensity in particular regions may be the cause of the formation of snow, rain, and hail. The electrical particles, being endowed with a great repulsive power, are supposed to keep in general the particles of vapour asunder; and when, from any cause, some given volume of air is deprived of its natural quantity of electricity, these particles unite by their mutual attractions, and thus form drops of rain or ice. From the showers which accompany a thunder storm, there is no doubt that electricity co-operates in some measure in the production of rain; and it may be remarked in support of the above hypothesis that rain is most abundant among mountains, their elevated summits being favourable for receiving and discharging electricity; while in some regions where thunder is little known there is also little rain.

But the theory first proposed by Dr. Hutton of Edinburgh (*Phil. Trans.*, Edin., 1784) is that which appears to correspond most satisfactorily to the observed phenomena of the atmosphere; and accordingly it has been adopted by nearly every distinguished meteorologist since that time. This theory will be briefly described.

The atmosphere surrounding the earth is known to consist of air and aqueous gas or vapour, both of which are elastic; and, according to the experiments of M. Gay-Lussac, the elasticity of the vapour is equal to that of the air at an equal temperature, both when the vapour exists alone, and when it is combined with the air; hence it is inferred that in the atmosphere the vapour and air are in mechanical union only, and also that the particles of the former have the power of moving freely in the intervals between those of the latter. The atmosphere is supplied with humidity by evaporation from the waters of the earth, and its power to hold the water in solution depends on its temperature, an increase of the latter augmenting that power, and a decrease diminishing it: but in the theory of Hutton, the diminution of the power takes place in a higher ratio than the diminution of the temperature.

Now the quantity of moisture in the atmosphere will at all times be nearly equal to the greatest quantity that can be maintained in it in a state of vapour at the existing temperature. Therefore if two volumes of air thus saturated with moisture, but of different temperatures, become by any means mixed together, a mean degree of heat results from the union; but the whole quantity of moisture in the sum of the volumes of air will, agreeably to the theory, be greater than that which is due to the mean temperature, and the excess will of course be condensed or precipitated. The vapour so condensed forms a cloud; and if this be specifically heavier than the air in which it is formed, it will begin to sink. Should the atmosphere near the earth be less dense than the cloud, the latter will continue to descend till it touches the ground, when the aqueous particles, if small, will form what is called a mist; or if large, and particularly if the condensation of the vapour has been rapid and copious, they will descend by their gravity in rain, snow, or hail, according to the temperature of the region through which they pass. It may happen however in the descent that a cloud arrives in a warmer region than that in which it was formed; in this case the condensed moisture may again become vapour, and the cloud may re-ascend to a region at which a new condensation takes place. But though it be true that some precipitation must follow, whatever be the difference between the temperatures of the two volumes of air, yet unless the mean of the two quantities of vapour should be greater than the quantity necessary for complete saturation at the mean of the two temperatures, the precipitation will not be perceptible in the form of rain.

In order to illustrate the general subject of clouds and rain, Mr. Daniell, in his 'Essays on the Constitution of the Atmosphere,' supposes, first, that the earth is a sphere of uniform temperature, and surrounded by an atmosphere of dry and permanently elastic fluid; and he shows that on this supposition the density of the air would diminish in a geometrical progression at elevations increasing by equal increments. He observes also that the temperature would decrease with the densities, and that the atmosphere would be constantly in equilibrio. This would continue to be the case if the general temperature of the sphere were to be increased, provided that increase were uniform at all points on its surface. Now, if the temperature of the sphere, instead of being uniform, were supposed to increase from the poles towards the equator, the unequal densities produced in vertical columns of the air by the differences of temperature at equal heights above the surface of the sphere, would give rise to lateral pressures which, in the lower strata, would produce currents tending from the poles towards the equator; but the elasticity of the air, which is constant near the surface of the sphere, varies with the height above that surface, according to such a law that, beyond a certain elevation, it would produce lateral pressures exceeding those which arise from the density in the neighbouring columns at equal altitudes, and thus there would arise a current in the upper regions flowing continually from the equator towards the poles.

He supposes next that the sphere is covered with water everywhere of equal temperature, and is surrounded by an atmosphere of pure aqueous vapour; and he shows not only that the density of this vapour would diminish upwards according to the law before mentioned, but that the atmosphere would in this case also be in equilibrio and transparent even when the general temperature of the sphere experiences a uniform increase. But if the temperature of the sphere were to increase as before, from the poles towards the equator, the density and elasticity of the vapour varying also with the temperature, there would arise by evaporation at the equator a current tending from thence to the poles, and this, being condensed in its course, would return from the poles towards the equator in the form of water. The condensation thus going on would cause the atmosphere to be constantly charged with clouds and rain. Unless however the excess of temperature at the equator were maintained by some foreign power, as solar radiation, the temperature over the whole sphere would by degress become equalised; the equatorial parts becoming cooled by evaporation, while the polar regions would become warmed by the condensation.

Mr. Daniell afterwards contemplates an atmosphere consisting of a permanently elastic fluid mixed with aqueous vapour, and surrounding a sphere of water of uniform temperature; and he observes that, since the evaporation would be slow, the small quantity of water precipitated would be almost immediately dissolved by the superior temperature of the stratum below, into which it would tend to fall; therefore this atmosphere would be free from clouds. But in the event of the temperature of the sphere increasing from the poles to the equator, the evaporation in the latter region would destroy the regular gradation of temperature in the atmosphere from the surface of the sphere upwards; the evaporated water rising to the middle regions would there, in consequence of the diminished temperature, give out its latent heat, and become condensed; then descending, it would acquire from below a new portion of heat, with which it would rise till it was again forced to part with its caloric. This process may be supposed to continue till those regions of the atmosphere become saturated with vapour, and at the same time rarified by the heat. The rarefaction of the air would diminish its resistance to the general movement of the vapour towards the poles, and thus the vapour would rush with force in those directions; but on arriving in latitudes at which the temperature is too low to allow the air to hold it in solution, condensation would take place, and clouds would be formed.

The circumstances just mentioned correspond nearly to those which would take place about the earth if local and other accidental circumstances did not interfere with the general process. In its actual condition, when a column of air vertically over any place is from any cause heated more than the neighbouring columns, it begins to ascend by its diminished specific gravity, the colder air of the vicinity flows in to fill up the void, and thus the relation between the temperature and humidity at the place is deranged. Then, agreeably to the general theory of Dr. Hutton, a precipitation of the vapours takes place.

In proportion to the density of the vapour, the magnitudes of the condensed particles of water are greater; in the upper regions of the air the cloud assumes a light appearance, but below it is more dark. After their formation, the clouds are driven about by the winds, receiving new accessions of precipitated vapour till the air is no longer capable of supporting them, and then their substance descends in rain, snow, or hail.

On the supposition that the surface of the earth is without inequalities, and that the temperature gradually diminishes from the equator towards either pole, it should follow that the rarefaction of the air and the evaporation of the water, and consequently the quantity of rain, must diminish according to some law with the distances of places from the equator. Now the mean temperature in any latitude being known, the quantity of moisture in the atmospherical column at that latitude can be found, since it depends on the temperature; hence knowing also the variations to which the temperature of the atmosphere at the place is subject in the course of the year, the mean annual depth of rain in that latitude may be computed. On such principles Humboldt has determined that the mean annual depth of rain should be, at the equator, 96 inches; in lat. 45°, 29 inches; and in lat. 60°, 17 inches. The circumstances however which render the temperatures in different latitudes, and even on the circumference of the same parallel, irregular, must produce irregularities in the quantities of rain which fall at different places; yet the results of observation show that, in proceding from the equator towards the north pole, there is in reality a diminution in the mean annual quantities of rain.

From an average of the observations made during fourteen years (1810 to 1823 inclusive), the mean annual depth of rain on the Malabar coast is 123·5 inches, and the mean annual temperature is 80·4° (Fahrenheit), but the annual depths of rain are very irregular and differ considerably. From a mean of observations for seven years (1817 to 1823 inclusive), the mean annual depth of rain at Bombay was only 85·24 inches. From a mean of observations during seventeen years (1802 to 1818 inclusive), Mr. Dalton makes the mean annual depth of rain at Manchester equal to 33·596 inches, the mean annual temperature being 47·6°; and here also the annual quantities of rain vary very irregularly. The same meteorologist estimates the average of the annual quantity of rain in England to be 31·3 inches; the greatest quantity being at Keswick in Cumberland (= 67·5 inches), and the least at Upminster in Essex (= 19·5 inches); but it is supposed that this estimate of the mean quantity is higher than the truth, because too many of the observations were made in the maritime counties, where the atmosphere may be expected to be the most humid. In regions where the trade-winds blow constantly, rain seldom falls; and the reason may be, that both the temperature and the currents of air being there nearly uniform, the vapours raised from the ocean are carried about the earth without suffering those partial accumulations by which condensation and precipitation might be produced. But elsewhere the irregular distribution of land and water, the existence of mountain-chains, and even the various capacities of different parts of the earth's surface for absorbing or communicating heat, independently of variations in the electricity of the air, are to be considered as the most frequent causes of perturbation in the general currents of the atmosphere, and consequently of the fall of rain.

The dense mists which rest on the ocean near Newfoundland are precipitations caused by inequalities in the temperature of the ocean in the line of the *Gulf-stream*. In the year 1821, in consequence of very strong winds between the tropics during the summer having caused an extraordinary difference between the levels of the waters in the Gulf of Mexico and those of the Atlantic Ocean, the stream of warm water was found to extend eastward of the Azores; and it deserves to be remarked that this unusual circumstance was attended, both in France and in England, by a very hot and damp winter, together with an excessive fall of rain. (Sabine, *Experiments on the Figure of the Earth*, 1825.) The rains which frequently deluge the tropical islands are in part produced by the volumes of air which are intermingled by the sea and land breezes; and those which fall at the time of the summer solstice in Africa may be ascribed to the immediate precipitation of the vapours which flow from the seas to supply the place of the rarefied air above the heated lands: while the drought which prevails in the sandy deserts of that quarter of the earth is explained by the level character of those deserts, over which the currents of air may be supposed to flow nearly without interruption.

From April to October, the winds blowing from the south-west towards the coast of Malabar are accompanied by heavy rains, and the circumstance may be accounted for by the vapours of the ocean being brought from a warm region to one which is less so, and consequently becoming there condensed and precipitated. On the other hand, the prevailing winds on the coast of Peru, being from the south and south-west, come from a cold to a warmer region; consequently a diminution of the degree of saturation must there take place, and the vapours remain suspended; accordingly it is found that rain seldom falls on that coast. The clouds which overhang the coast of Malabar during the monsoon above-mentioned are arrested by the chain of the Ghauts, and while it rains on the western side the fair season is enjoyed on the coast of Coromandel. Again, the currents of air which pass over Peru, in crossing the chain of the Andes, where the temperature is lower, become condensed by the cold, and the rain is there precipitated in abundance. The vapours which come from the Atlantic ocean, and pass over the south-western counties of England, must be more abundant than those which arrive there from the continent of Europe; and from observations made at Penzance, the rains which accompany the westerly winds at that place exceed those produced by the easterly winds in the ratio of about three to one.

In tropical regions the quantities of rain which fall in different months of the same year are very unequal: at Bombay the mean monthly depth in June was found to be 24 inches, and in October, 1·26 inches. In temperate climates the quantities differ much less, but more rain falls during the second half year than during the first. The means of observations continued during 40 years at London give, for the depth of rain from January to July inclusive, 8·539 inches, and from July to December inclusive, 12·147 inches.

In general the lowest stratum of air about the earth contains the greatest quantity of water in solution; and hence it might be expected that more rain should fall on low level plains than in elevated countries. The contrary however is the fact: and this may be accounted for by the variety of currents among mountains, and by clouds resting frequently on the summits of hills without descending to the plains. While the average annual depth of rain at Keswick is 67·5 inches, in the interior of the country and on the sea-coast it is but 25 inches: and while the average depth on the St. Bernard is 63·13 inches, that at Paris is 20 inches only. Yet, from the observations of Dr. Heberden, Mr. Howard, and M. Arago, it appears that the depth of rain on the level of the ground is greater than at the top of a building. The first of these philosophers found that the annual depth at the top of Westminster Abbey was 12·099 inches, while at a lower level, on the top of a house in the neighbourhood, it was 18·139 inches; and on the ground, in the garden of the house, it was 22·608 inches. M. Arago observed, from observations during twelve years, that on the terrace of the Observatory at Paris the annual depth was 50·471 centimetres (19·88 inches), while in the court of that building, which is 28 metres (30 yards) lower, the annual depth was 56·371 centimetres (22·21 inches).

Mr. Howard has observed that, in this country, when the moon has south declination there falls but a moderate quantity of rain, and that the quantity increases till she has attained the greatest northern declination; and on some such results of observation the popular opinion that there is a connection between the alternations of rain and fair weather and the changes of the moon may be founded. Our knowledge of the variations to which the temperature of the air is subject, is however yet too imperfect to allow much dependence to be placed on predictions relating to the weather which are formed from the moon's phases, or even from variations in the state of the barometer or hygrometer

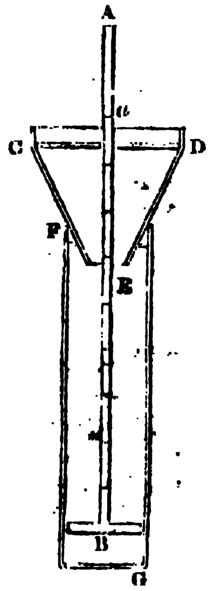
RAIN, FOSSIL. Singular as may appear the notion that the impressions of rain should be recognisable and be recognised on the surfaces of stratified rocks, the opinion is held by some eminent geologists, on the evidence of specimens of new red-sandstone taken from the Storeton Quarries near Liverpool. In March, 1839, Mr. Cunningham, to whose researches in the Storeton quarries we are indebted for much of our knowledge of the foot-prints of Cheirotheria and other antient animals, communicated a paper on the subject to the Geological Society of London. 'In examining some of the slabs of stone extracted at the depth of above 30 feet, Mr. Cunningham observed that their under surface was thickly covered with minute hemispherical projections, or casts in relief, of circular pits in the immediately subjacent layers of clay. The origin of these marks, he is of opinion, must be ascribed to showers of rain, which fell upon an argillaceous beach exposed by the retiring tide, and their preservation to the filling up of the indentations by sand. On the same slabs are impressions of the feet of small reptiles, which appear to have passed over the clay previously to the shower, since the foot-marks are also indented with circular pits, but to a less degree, and the difference Mr. Cunningham explains by the pressure of the animal having rendered these portions less easily acted upon.' If these impressions on the clay be really the marks of rain or hail (a specimen is before us, and it certainly resembles such impressions on clay), perhaps the easiest way of comprehending the preservation of them is to suppose dry sand drifted by the wind to have swept over and filled up the foot-prints, rain-pits, and hollows of every kind which the soft argillaceous surface had received. (*Geological Proceedings*, 1839.)

RAIN-GAUGE, a vessel for measuring the quantity of rain which falls on any particular part of the earth's surface, the quantity being indicated by the depth of the precipitated water which would cover the ground about the spot, supposing the ground to be horizontal and that the water could neither flow off nor penetrate into the soil.

In order to ascertain the quantity of rain which has fallen during the continuance of a shower, it might suffice to place a prismatical or cylindrical vessel, open at the top, in a horizontal position on the ground or on the top of a build ing, and, when the shower has ceased, to measure the depth of the water in the vessel by a scale of inches. But, unless the depth were ascertained immediately, a portion of the water would be carried off from such a vessel by evaporation, and the measure would be less than it ought to be. The difficulty also of ascertaining the true amount of a small depth of water would render the instrument of no practical use. For the purpose therefore of obtaining a more correct estimate of the quantity of rain, it has always been the practice to receive the water in a second vessel, or in a tube, the area of whose horizontal section is less than that of the first, so that the height of the column may be greater. And, since the heights of equal quantities of water in two prismatical or cylindrical vessels are inversely proportional to their bases, it is easy to perceive how a rod may be graduated so as to show, in inches, the depth of water in the upper vessel, and consequently the depth which would have lain on the ground if no absorption had taken place.

Originally this instrument, which has been called indifferently udometer (ὕδωρ and μέτρον), pluviometer (pluvia), and ombrometer (ὄμβρος, rain), was nothing more than a prismatical box, having a square base, open at the top and communicating with a prismatical box, placed vertically under it, by means of a pipe open at both ends; the area of a horizontal section of the lower box being, for the reason above given, less than that of the upper box. But it is evident that a prismatical or cylindrical vessel must retain, by adhesion to its sides and bottom, a sensible portion of the water which enters it; and consequently the depth measured in such vessel must indicate a quantity of rain less than that which has really fallen; it has therefore been customary of late to make the upper part of the vessel in the form of a funnel, or inverted cone.

most general construction of a rain-gauge is shown in the subjoined diagram, which represents a vertical section of the instrument. The part CDE is a conical funnel, open both at top and bottom, and the lower extremity enters into the cylinder FG below, which thus receives the rain from the funnel. The rod AB passes through a perforation in a bar CD (in the direction of a diameter of the cone at its upper surface), and is attached, at B, to a circular piston, which has nearly the same diameter as the interior of the cylinder: the weight of the piston and rod is such as to allow the former to float with its upper surface on a level with the surface of the water; and the graduations, which are numbered towards B, commence from a point *a* on a level with the upper surface of the bar CD, when the piston B touches the bottom of the cylinder. A rim, of a cylindrical form, rises a little way above the upper extremity of the conical part of the funnel, in order to prevent the rain-water, which would strike the interior of the latter near that extremity, from being thrown out in consequence of the shock.



The diameter of the funnel at the top may be 12 inches, and that of the cylinder six inches; in which case the area of the horizontal section on which the rain falls will be to that of the cylinder in the ratio of four to one. Hence a depth of water equal to one inch at the horizontal section will be expressed by a space equal to four inches on the length of the rod; and, each of such spaces being divided into 100 parts, the depth of water at the said section will be indicated in hundredths of an inch. The height of the cylindrical vessel below the funnel may be from 25 to 30 inches

For the sake of diminishing the evaporation and of measuring small quantities of rain with greater precision, the diameter of the cylinder is sometimes reduced to two inches, and the collected water is, by means of a small pipe, inserted in the bottom of the cylinder, and furnished with a cock made to pass into a glass tube whose interior diameter is half an inch. In this case, the diameter of the upper extremity of the funnel being the same as before, the area of the surface which receives the rain from the atmosphere will be to the area of a horizontal section of the glass tube as 576 to 1. Consequently a shower of rain whose depth on the ground might be one-hundredth part of an inch would be indicated by 5·76 inches in the tube.

The funnel of the cylinder may be of tin or copper, and, however the instrument be constructed, it is evident that it should be placed in a vertical position in some place where no object may interfere with the free descent of the rain into the funnel. It is usual to observe the quantity of water in the vessel every morning, if rain has fallen during the preceding twenty-four hours; but, as some evaporation will take place, it would be advantageous to make the observations more frequently.

The sum of all the depths observed during any period of time, as a day, month, or year, will give the whole quantity of rain which has fallen in that time at the place. It is supposed that the rain falls uniformly over the tract of ground lying within the limits of the shower, and consequently that the quantity which passes through the circular area at the upper surface of the cone is equal to that which falls upon an equal area of ground anywhere within those limits.

A rain-gauge can never serve further than to give an approximation to the quantity of rain which may have fallen, since some of the water will always adhere to the sides of the vessel, but the following method of ascertaining the allowance to be made for the quantity thus lost has been recommended:—Let a sponge be made damp, yet so that no water can be squeezed from it, and with this collect all the water which adheres to the funnel and cylinder after as much as possible has been drawn off: then, if the sponge be squeezed and the water from it be received in a vessel which admits of measuring its quantity, a near estimate may be made of the depth due to it; and this being added to the depth given by the instrument would probably show very correctly the required depth of rain.

RAINBOW, a circular arch of variously coloured light which is visible in the heavens when the sun or moon is shining, and when, at the same time, a shower of rain is falling on the opposite side of the spectator. When the rain is abundant, a second bow is commonly seen on the exterior, and concentric with the first; their common centre being in a line drawn from the luminary through the eye of the spectator and produced towards the opposite part of the heavens. Both bows consist of concentric bands of the different prismatic colours arranged as they appear in the solar spectrum, but the order in which they are disposed in the first bow is inverted in the second. The lower edge of the interior bow is violet and the upper edge is red; on the contrary, the lower edge of the exterior bow is red and the upper edge is violet.

The rainbow is a phenomenon which appears at all times to have been understood to depend upon the light of the sun or moon and the drops of falling rain, but the first complete explanation of the circumstances connected with it is due to Newton (*Optics*, lib. i., p. 2, prop. 9). In the beginning of the sixteenth century no better notion was entertained of the cause of the phenomenon than that the interior bow was a distorted reflection of the sun's image from the surface of a cloud, and that the exterior bow was a reflected image of the first. But the reflection of light is not capable of producing different colours, and it is said that Fleischer of Breslau (1571) was the first who entertained the idea that the particles of light from the sun entered into the drops of rain. His opinion was that a ray of light suffered one refraction on entering and another on leaving a drop; and that it entered the eye of the spectator after reflection from the surface of a second drop. It appears that Kepler, in a letter to Harriot (1606), suggested that the particles of light, in a ray which is a tangent to some part of the surface of a drop of rain, might enter the drop by refraction, and that this ray, being subsequently reflected at the interior surface of the latter, might enter the eye of the spectator after being again refracted on leaving the drop. The hypothesis is worthy of Kepler's sagacity, and, as far as it goes, it differs from the fact only in the manner in which the incident ray is supposed to fall on the drop. Newton ascribes the first idea of the true explanation to Antonio de Dominis, bishop of Spalatro, whose work, 'De Radiis visûs,' was published in 1611, but is said to have been composed in 1590; the work however appears to have been so obscurely written and to betray so much ignorance of the laws of optics, that it is doubtful whether or not the author had any more than a vague conception of the cause of the colours. (See Montucla, *Histoire des Math.*, tom. ii.)

Descartes is certainly the first who has distinctly explained the causes by which the two bows are produced, and he states (*Meteora*, cap. viii.) that he detected those causes on observing the phenomena presented by a glass globe filled with water, which he placed in various positions with respect to the sun. He shows that the interior or primary bow is produced by rays from the sun falling upon the drops of rain near their upper surfaces, where, being refracted, they pass to the side of the drop which is farthest from the sun and spectator; from thence they are reflected towards the lower surface, and, on quitting the drop, they suffer a second refraction. He shows also that the exterior or secondary bow is produced by rays from the sun falling upon the drops of rain near their lower surfaces, where, being refracted, they pass, as before, to the farther side of the drop: from thence they are reflected towards the upper surface, and there they suffer a second reflection. After this they pass to the side of the drop which is nearest to the sun, and from thence they emerge after a second refraction. Now it is not sufficient that the pencils of light which are incident on the drops of rain should be so refracted and reflected; it is moreover necessary that each pencil on emerging from the drop should consist of parallel rays of light, that, when it enters the eye of the spectator, it may produce in the mind the perception of brightness; and Descartes determined by computation the positions of the incident and emergent rays so that this effect may be produced.

Thus, let SI (*fig.* 1) be a very slender pencil of rays of some one colour incident on a spherical drop of water at the angle AIS, and let this angle be such that the rays in the pencil may, by the laws of refraction in water, converge at B; then, though many rays will pass through the drop at that point and be dispersed, yet many will be reflected from thence as from a radiant point, and will emerge at K in parallel directions, as they entered at I, so that if KE be the direction of the emergent pencil, the angle CKE will be equal to AIS: the angle made by the lines SI and EK produced was found by Descartes to be about 42 degrees. If the angle AIS were varied, the rays of the pencil would leave the drop in a divergent state, and then the impression which they would make on the eye might be too feeble to produce the sensation of brightness. Again, let SI (*fig.* 2) be a very slender pencil of rays of some one colour incident on a spherical drop of water at the angle AIS, and let this angle be such that, by the laws of refraction in water, the rays after crossing at X and being reflected from B may pass from B to C in parallel directions; then, after a second reflection, crossing at Y and being refracted at K, they will emerge in parallel directions as they entered at I, so that if KE be the direction of the emergent pencil, the angle DKE will be equal to AIS: the angle made by the lines SI and EK was found by Descartes to be about 52 degrees. If the angle AIS were varied, the rays of the pencil would leave the drop in a divergent state.

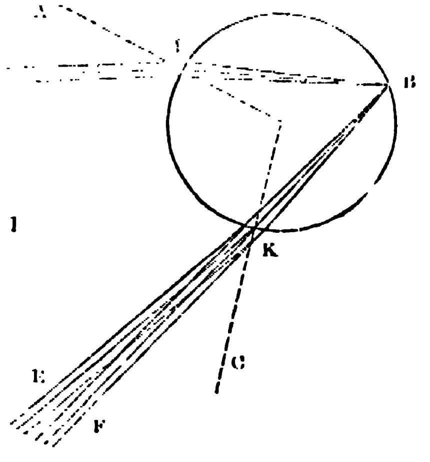


Fig. 1

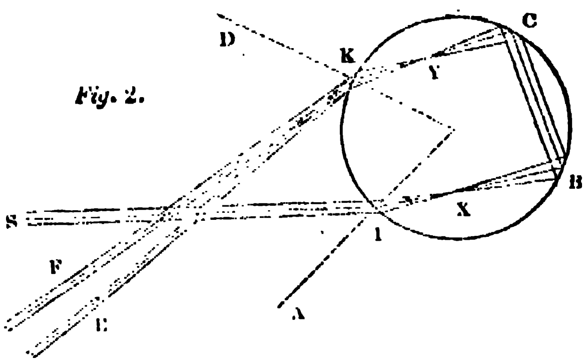


Fig. 2.

Now let A, B, C, D (*fig.* 3) be four globules of rain in a cloud covering a considerable part of the heavens on one side of the horizon. Let E be the eye of the spectator, and, on account of the remoteness of the sun, let the rays of light which proceed from his disk be considered as parallel to one another. Let SE be a line drawn from the sun through the eye of the spectator, and let it be produced towards O: also let SA, SB, &c. be very slender pencils of parallel rays (supposed at present to be of one colour) falling upon the globules of water. Let the refraction and reflection of these pencils in A and B be similar to those which are shown in *fig.* 1; and the refraction and reflection in C and D be similar to those in *fig.* 2: also from the points of emergence suppose lines to be drawn to E. It is evident, on account of the parallelism of the lines SO, SA, &c., that if the angle AEO or BEO were nearly equal to 42°, and if the angles CEO or DEO were nearly equal to 52°, the eye would be affected by the sensation of brightness as explained above; therefore if the lines AE, BE, &c. were to revolve conically about EO as an axis, all the globules of rain upon the conical surfaces so described would send pencils of parallel rays to the eye, and two concentric arches of bright light would be seen in the heavens. This hypothesis accounts satisfactorily for the existence of two concentric bows of bright light, but it affords no indication of the bands of colours of which they consist. Descartes however very sagaciously refers their cause to the decomposition of light on entering and quitting the drops of rain; observing that the convex surfaces of the latter must produce effects similar to those which take place when light is made to pass through the plane faces of a triangular prism of water.

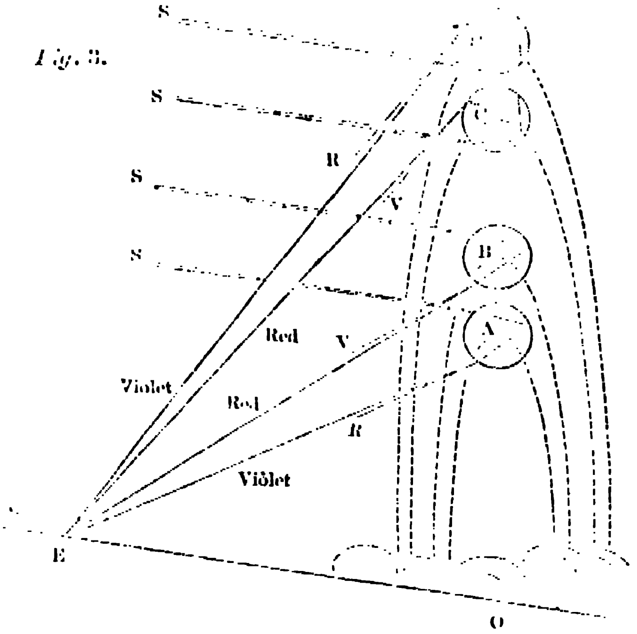


Fig. 3.

But when Newton had discovered the different degrees of refrangibility in the different coloured rays which compose a pencil of white or compounded light, he was able to assign immediately the cause of the coloured bands in the rainbow, the order of their position, and the breadth which they must occupy. Thus, if the incident pencil SI (*figs.* 1 and 2) had consisted only of violet-coloured light (for example), the angle AIS must have had that particular value which alone would allow the rays of the emergent pencil to be parallel to one another; but if the incident pencil were supposed to consist of light of another colour, as red, it should have fallen nearer to the centre of the drop, in order that the angle AIS might have the particular value which would allow the rays of the emergent pencil to be parallel to one another. Since the red rays suffer less refraction than the violet rays, if KE be the direction in which the latter emerge from a drop, KF in both figures may represent the direction in which the former would emerge; and if the eye be situated so as to receive the pencil KE, it would have the impression of a violet colour; while, if situated so as to receive the pencil KF, it would have that of a red colour. We have mentioned, for simplicity, only the violent and red rays, which form the two extremes of the coloured spectrum; but it is easy to conceive that a like explanation might be given for rays of the intermediate colours. And since the pencils of all the different colours diverge from one another on quitting a rain-drop, it is evident that the spectator whose eye receives one of the pencils will be affected by the colour of that pencil only, the other pencils passing either above or below his eye.

Newton has determined by computation that when the angle AEO (*fig.* 3) = 40° 17′, the violet rays alone, after two refractions and one reflection, will enter the eye of the spectator at E, the other rays falling below; and when ∠ BEO=42° 2′, the red rays alone will enter the eye, the violet rays passing above. Again, when ∠ CEO=50° 59′, the red rays only will enter the eye, after two refractions and two reflections, the violet rays falling below; and when ∠ DEO=54° 9′, the violet rays alone will enter, the red passing above. If the interval between the drops A and B, and also between the drops C and D, were occupied by other drops, it may readily be imagined that the pencils of parallel rays which come from them to the eye would be of all the prismatic colours between the red and violet, and that thus there would appear in the heavens two narrow spectra: the length of that between A and B would be 1° 45′, and of that between C and D would be 3° 10′. Therefore, if all the lines drawn to E from the drops in the two spectra were to revolve conically about EO as an axis, the drops on these lines would be in situations to send to the eye rays of their own proper colours, and thus there would exist the appearance in the heavens of two concentric bands of variously coloured light.

But it has been here supposed that the pencils SA, SB, &c. come from the centre only of the sun's disk, whereas each point of the disk produces two bows similar to those which have been described: therefore the lower extremity of the interior bow will be a violet band whose breadth is equal to half the diameter of the sun (suppose 15′), and which is situated immediately below the violet line formed by the centre of the disk; and in like manner the upper extremity of the interior bow will be a red band whose breadth is also = 15′, and which is situated immediately above the red line formed by the centre of the disk: consequently the whole breadth of the interior bow is about = 2° 15′. Similarly 30′ (the measure of the sun's diameter) must be added to the breadth of the outer bow, as before determined, which thus becomes about = 3° 40′. In both bows, the colours between the violet and red are less distinct than those two colours, because of the interference of the coloured light from all parts of the disk.

On account of the two reflections which take place in the interior of the drops which give rise to the outer bow, while there is but one reflection in those which produce the inner bow, there must be a greater quantity of light lost by transmission through the drops in the former case than in the latter; and hence the outer bow is always fainter than the other. The interval between the primary and secondary bow has occasionally been observed to be occupied by an arch of coloured light; but this, which is not always concentric with the others, has been ascribed to some reflection of one of those bows.

A rainbow can never be greater than a semicircle, if the spectator be not on elevated ground; for if it were, the centre of the bow would be above the horizon, and the sun, which is in a line drawn through that centre and the eye, would then be below the horizon; but, in this case, the sun could not shine on the drops of rain, and consequently there would be no bow. When the rain-cloud is of small extent, there is seen only that portion of the bow which the cloud can form; yet the bow is sometimes seen against the blue sky, when there exist in the air vapours which are not dense enough to be visible in the form of a cloud; and a portion of a bow has occasionally been seen in an inverted position on the ground by the refraction of the light in drops of rain adhering to the grass or the leaves of trees. It may be added that a coloured bow similar to that which is produced by rain may be observed in the spray from a fountain when the jet of water is agitated by the wind, and also in the mists which at times lie upon low grounds.

The lunar rainbows appear in general white: and when they are coloured, they differ from those produced by the sun only in the colours being much more faint.

The circle of light which is occasionally seen surrounding the sun or moon at some distance from the disk of the luminary, is called a *halo* or a *corona*, and is caused by the refractions of light in particles of ice which float in the air. This phenomenon having some resemblance to that which has been just described, a brief explanation of it may be with propriety introduced in this place.

The cause of the halo was first investigated by Descartes, who observes (*Meteora*, cap. ix.) that this phenomenon differs from the rainbow, inasmuch as the latter is seen only while rain is falling, whereas halos are never seen at such times; and he ascribes their formation to refractions of light in star-shaped crystals of ice, which he remarks are thicker in the middle than at the edges, and are therefore proper to produce refractions.

Sir Isaac Newton also ascribes the halo to refraction in floating hail or snow; but it appears that Mariotte (in 1686) was the first who considered it to be produced by refraction in the small equilateral prisms of ice which abound in the air in a separate state before they unite together and form the flakes which descend during severe frosts; and Dr. Young, without being aware of Mariotte's hypothesis, entertained and developed the same idea.

According to this philosopher, there may be in the air an immense number of prismatic particles whose transverse sections are equilateral triangles, the planes of the sections deviating but little from one passing through the sun or moon and the spectator. Now, by the laws of refraction in water, when a pencil consisting of parallel rays of light, as SI (*fig.* 4), is incident on a face of such prisms, and makes the angle of incidence SIP equal to about 41° 50′, the axis KE of the emergent pencil will make an equal angle EKQ on the other face, and the angle of deviation SAF, or the angle between the incident and emergent ray will be 23° 40′. Therefore if the line FE produced to the spectator's eye were to revolve conically about a line joining the sun and spectator as an axis (which line, since the sun is very remote, may be considered as parallel to SA), all the prisms similarly situated on such conical surface would transmit to the eye pencils of parallel rays, if the light were of one colour, and thus there would be produced the perception of a bright circle in the heavens, having the sun for its centre; its radius subtending at the eye an angle of about 23° 40′. The angle SAF varies very slowly, the variation amounting only to about 3°, when the angle SIP varies as much as 30° consequently there may be innumerable prisms in the air in such positions that the angle SIP, for pencils incident upon them, does not vary more than 15° on either side of that which has been above supposed; and these will transmit to the eye light, in such abundance as to produce the appearance of an annulus about 3° broad. This is the appearance of the common halo. Dr. Young supposes further, that when there is a very great number of particles of ice

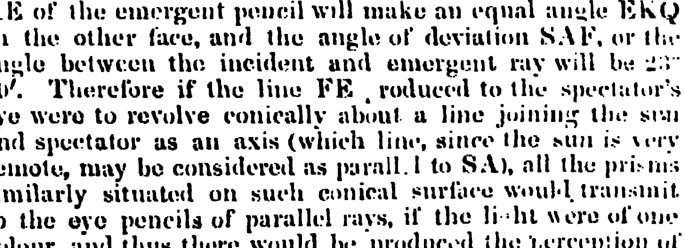


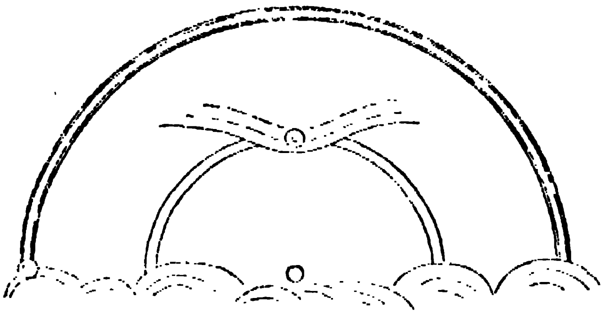
Fig. 4.

so formed, the rays, after being refracted through one prism, may fall on another and there suffer a like refraction. This would produce the appearance of a second circle concentric with the former, and at twice its distance from the sun; thus there might be produced at one time two haloes, of which the distance of the exterior from the sun would be above 47 degrees.

The parhelia which sometimes appear above or below the true sun, are supposed to be produced by the refractions of light in equilateral prisms of ice, when such prisms happen to be very short, so as to have the form of thin triangular plates, and when the flat sides are in or near a vertical plane passing through the sun and spectator. A great number of such prisms would, by refracting the light as above shown, give rise in the halo to the appearance of a bright spot resembling the true sun, and in a vertical line passing through it; and, if the prisms in such positions have a certain length, the image of the sun would be distorted, and might assume the appearance of being winged. The horizontal parhelia are accounted for in a similar manner. Sometimes false suns (*anthelia*) appear on the side of the heavens which is opposite the true sun; and these are supposed to be produced by two refractions and two internal reflections in such prisms of ice. In this case the images ought to be 60° beyond the halo; that is, they ought to be about 83° from the true image of the sun.

Subjoined is a sketch of the double halo with parhelia, which was observed by Sir Henry Englefield at Richmond in 1802. (Young's *Nat. Phil.*; and *Journal of the Royal Institution*, vol. ii.)

Fig. 5.



RAISIN, or RAISEN, MARKET. [LINCOLNSHIRE.]

RAISINS. The dried fruits of several varieties of the vine are called raisins, a term derived from the French, raisin in that language being a general name for grapes, the dried fruit being distinguished as *Raisins secs ou passés*.

Raisins are named after the countries where they are produced, or the places whence they are imported; as Malaga, Valencia, and Smyrna. The peculiar small and generally seedless grapes, formerly called Corinths, are now better known as the dried or Zante currants of the shops. Other denominations by which different kinds of raisins are distinguished, arise from the variety of grape employed, or from the mode of preparation; as muscatels, blooms, sultanas, raisins of the sun, and lexias.

The most simple, and, when circumstances are favourable, the best mode of preparation is to dry the grapes, after being cut when fully ripe, by exposure to the heat of the sun on a floor of hard earth or of stone. Another method is to cut the stalk half-way through when the grapes are nearly ripe, and leave them suspended till the watery part is evaporated; the flow of sap is in a great measure prevented from entering the fruit, in consequence of the incision, and whilst evaporation continues to go on undiminished, desiccation must take place.

Some sorts are prepared by dipping the grapes in a ley, and afterwards drying them in the sun. This ley is formed of water, wood-ashes, and a small portion of oil of olives. The ashes of vine branches and tendrils are preferred. In Valencia, in addition to the ashes of rosemary and vine branches, a little slacked lime is used. Raisins so prepared are called lexias; whilst those prepared entirely by sunheat are denominated raisins of the sun.

A fourth method, only used for raisins of inferior quality, is to dry the grapes in an oven.

The currant-grapes are gathered in the end of August and beginning of September. Rains often spoil the crop when they occur at the time of gathering or drying. The fruit, when sufficiently dry, is separated from the stalks by small rakes, and afterwards stored in magazines, '*seraglie*,' constructed somewhat like a lime-kiln, having an opening at top, where the fruit is put in, and a door at bottom, opened only at the time of sale. The fruit is rendered so compact by its own weight, that considerable force is requisite to break it up for the purpose of being packed in the large casks in which it is exported.

The Malaga raisins are esteemed the finest; and th muscatels from thence exceed all others in price by at least one-third. The black Smyrna raisins are those of least value.

Of all the known varieties of grapes, the white muscat of Alexandria is that which furnishes raisins of the finest description. The berries are large, oval, white, rather firm-fleshed, with a rich muscat flavour, superior in this respect to all others that have hitherto been fruited in this country. From the synonyms which it has obtained, its extensive cultivation and use as a raisin grape may be inferred; for example, it is called the muscat of Jerusalem, Malaga, Passé-Musquée, Passé-Longue Musquée, Muscat d'Espagne, &c. There is also a black muscat of Alexandria, and a red muscatel, both of which have a firmness of pulp which renders them fit for drying; for grapes, however rich they may be, and excellent in a fresh state, yet if they do not possess a certain degree of firmness, are unfit for drying, inasmuch as their substance would be too much dissipated in the process.

The variety of grape-vine that bears the small and generally seedless bunches of grapes, which, when dried, become the *Corinths* or *Zante currants* of the shops, belongs to *vitis vinifera*, and is not a distinct species, as it has been by some supposed. This has been proved by plants sent direct from Zante, and which have been fruited in the garden of the Horticultural Society. In a good season it is capable of being ripened against a south wall. The berries have the same size and character as those imported, being small and seedless, except occasionally one that acquires a somewhat larger size and contains a seed; such are even found amongst imported fruit. The variety is figured in the *Hort. Soc. Transactions* (2nd series), vol. i., p. 246. According to M. Beaujour, the first grapes of this variety that appeared in the great marts of Europe were brought at the beginning of the seventeenth century from the Gulf of Corinth, and hence were called *Corinthian* raisins. Latterly however the cultivation has become chiefly confined to the western territories of the Morea and the Ionian Islands, particularly those of Zante, Cephalonia, and Ithaca. The fertile island of Zante is the place where this variety of grape is produced in greatest abundance.

The chief employment of raisins in medicine is to flavour unpleasant mixtures, or for their demulcent properties. In the former point of view they are unimportant; in the latter, of considerable utility. Fresh grapes are cooling, aperient, moderately nutritive, and demulcent. Their use in the south of France is thought to contribute greatly to the amelioration which consumptive persons experience there, and in some instances their effect is so striking as to have given rise to the term *cure de raisins*. The dried fruit is less acid, but more nourishing, and more demulcent. It possesses all the soothing qualities of jujube, and is much cheaper. It may be easily made into a conserve by removing the seeds and beating the pulp into a thick mass. For persons with irritable throats and liable to winter coughs, a portion of this put into the mouth before going into the open air is an excellent protective measure, and often prevents cough, which, when once excited, it is difficult to allay. An excellent demulcent drink is made from a compound of barley and raisins. Currants contain more acid than common raisins, and should be preferred where an aperient action is desired.

An oil exists in the seeds of the grape, in the proportion of 12 pounds of oil to 100 pounds of seeds. Though it is not obtained without difficulty, it is extracted in Italy in large quantity. When heat is used, it has a harsh taste, and is mostly used for burning; but when cold-drawn, it may be used for food.

Tannin of the purest kind may be obtained from the seeds of the grape.

Nearly all the raisins imported into this country are from Spain and Turkey. Of the total quantity imported, 99 per cent. is from these countries, namely, 64 per cent. from Spain, and 35 per cent. from Turkey. A small supply is received from Portugal, Italy, and the Cape of Good Hope.

Malaga and Valencia are the two great Spanish ports of shipment. At the commencement of the present century, Laborde estimated the exports of Malaga at 240,577 cwts., valued at 625,000*l.*, and those of Valencia at 36,500 cwts., valued at 11,800*l.* In 1829 however M. Moreau de Jonnès (*Statistique de l'Espagne*) estimated the total value of fruits exported from Spain at only 300,000*l.* In 1834 the exports of raisins from Malaga consisted of 274,626 boxes and 162,806 barrels, one-half of which were shipped for the United States, and one-sixth for England. Nearly the whole of the supply from Turkey is shipped at Chesmé and Vourla, small ports near Smyrna, the only raisins shipped at Smyrna being the small fine species called sultanas. Chesmé owes its prosperity entirely to this trade; and the Franks go down there in the month of October merely to ship the fruit which is produced in great abundance in the vicinity. Mr. Macfarlane states (*Constantinople in* 1829) that fourteen English vessels, three Austrian, and one American took fruit (many of them whole cargoes) during his stay in the town.

In August, 1834, the import duty on raisins was reduced to 15*s.* per cwt. on foreign, and 7*s.* 6*d.* if from British possessions. The duty had previously been:—from British possessions 10*s.*, foreign sun 42*s.* 6*d.*, other sorts 22*s.* (reduced in 1829 to 20*s.*). In the five years from 1829 to 1833 the old duty produced annually 154,748*l.*; and in the five years following the reduction from 1835 to 1839, the annual average duty amounted to 120,520*l.* The average annual consumption in the United Kingdom, in each of the following periods of five years, was as follows:—1820-4, 138,287 cwt.; 1825-9, 144,141 cwt.; 1830-4, 146,559 cwt.; 1835-9, 160,740 cwt. The consumption of 1839 exceeded any previous year, being 179,335 cwt. Since the reduction of the duty on foreign wines, the use of raisins in this country for making sweet wines has been greatly diminished, and thus the beneficial effect of lowering the duty on raisins is not so apparent as it would otherwise have been.

RAJA is a Sanscrit word, signifying king or ruler, and is the same word as the Latin *rex, reg-is.* In the antient writings of the Hindus the word is applied to all the different kings or princes of Hindustan, and the title is still given to native princes.

RAJAMUNDRY, the name of a district and town of Hindustan, in the presidency of Madras and province of the Northern Circars. [Circars, Northern.]

RAJAST'HAN. [Rajpootana.]

RAJMAHAL, a town of Hindustan, in the presidency and province of Bengal, on the west bank of the Ganges, in 25° 2′ N. lat. and 87° 53′ E. long. Though formerly a large city, and at one time the capital of the province of Bengal, it now consists of little more than a long street of mud huts, some tombs and dilapidated mosques, and the ruins of a vast palace, which was built by the Sultan Sujah, brother of the emperor Aurungzebe, and completed in 1630. In the following year however a fire destroyed the greater part of the town and a considerable part of the palace; and not long afterwards a branch of the Ganges changed its course, and carried away nearly all the houses which remained. The Mogul governor of Bengal was then obliged to transfer his residence to Dacca, and Rajmahal has continued in a state of decay ever since. Its population however is said to be still not much less than 30,000.

RAJMAHAL HILLS, a group of mountains which derive their name from the town of Rajmahal, near which the southern part of them commences: they extend about 60 miles northward along the west bank of the Ganges. They form a detached mass, resemble the greater part of the Welsh mountains both in height and general appearance, and occupy an area perhaps equal to Merionethshire and Caernarvonshire. They are bounded on all sides by a level country, and rise from the flat surface of Bengal as if out of the sea. They are well wooded, and there is much thick jungle, so that they abound in wild animals of all kinds, from the jackal to the tiger, and from the deer to the elephant and rhinoceros.

The Rajmahal Hills, and indeed all the hilly country between Rajmahal and Burdwan, are inhabited by the *Puharrees* (or mountaineers), who appear to be an aboriginal race, differing from the inhabitants of the plain in features, language, manners, and religion. They are easily distinguishable from the Hindus by their long narrow eyes, broadish faces, and flattish turned-up noses; in stature they are rather short, but strong and active. They live chiefly by the chace, in which they use bows and arrows, few of them having fire-arms, and they shoot the larger animals with poisoned arrows. In addition to hides and game, they dispose of wax and honey, in which their hills abound, and they cultivate millet in considerable quantity.

Their language differs very remarkably, both from the Hindustanee and the Bengalee, but is said to bear a striking resemblance to that of the Bheels and the Gonds, so that these tribes are apparently different branches of the same great family, which extends over all the mountainous centre of India. [Hindustan, p. 221.] At some remote period they have probably been driven to these mountain-wilds by the tribes professing the Brahminical faith.

The villages of the Puharrees are very small and wretched, but the inhabitants pay no taxes, and live under their own chiefs under British protection. The men, being chiefly occupied in hunting, dislike work, but the women are industrious in cultivating the little patches of garden round their villages. Each village has a chief, and a number of villages compose a district, over which also there is a chief. Inferior crimes are tried by a jury of five old men in every village; but capital crimes are tried in the presence of the European judge by an assembly of village chiefs presided over by a district chief. Polygamy is not forbidden, but is rare.

The Puharrees have no castes; they care nothing for the Hindu deities: and they have no idols or images of any kind. A black stone, found in the hills, is consecrated by some ceremonies, and used as an altar. Buffaloes, hogs, fruits, fowls, grain, and spirits, are on certain occasions offered up to the gods, and afterwards feasted on. Prayer to 'Budo Gosaee,' which in their language means the supreme God, is strictly enjoined and practised morning and evening. They have several inferior deities, and also some evil ones. They believe that the souls of the good are sent back to earth in the bodies of great men, and those of the wicked in the form of brutes and even trees.

Till within the last sixty years a deadly feud had existed between the Puharrees and the inhabitants of the neighbouring lowlands, and as the former were continually making forays, the Mohammedan zemindars shot them like mad dogs whenever they came within reach. But Mr. Cleveland, having been appointed judge of Boglipoor, rigorously forbade and promptly punished all violence from the zemindars against the Puharrees; he got some of the latter to enter his service, and took pains to attach them to him, and to learn their language; and at last raised a corps of Sepoys from among them, which he stationed at Sicligully. Judge Cleveland died in 1784, in the twenty-ninth year of his age, and a monument was raised to his memory near Boglipoor, at the joint expense of the Puharree chiefs and the lowland zemindars, and was endowed by them with some lands for keeping it in repair. The natives meet once a year, in considerable numbers, and have a handsome 'poojah,' or religious spectacle, in honour of Cleveland's memory. A school has since been re-established by Lord Hastings, for the Puharrees, at Boglipoor, which was originally set on foot by Cleveland, but was shamefully neglected by his successors in office.

(Heber's *Narrative of a Journey through the Upper Provinces of India*, London, 1828.)

RAJPOOTA'NA, an extensive territory of Hindustan, so called because the greater part of it belongs to the Rajpoot princes. It is, to a considerable extent, coincident with the antient province of *Ajmeer. Rajast'han*, or 'the abode or country of princes,' is another name for the same territory. Rajpootana is situated between 23° 45′ and 31° N. lat. and 70° 23′ and 77° 45′ E. long. It is bounded on the north by Lahore, on the north-west by Mooltan, on the west by Sinde, on the south by Gujerat and Malwa, and on the east by Agra and Delhi; but the boundaries are very irregular, and not distinctly defined. Its greatest length, from south to north, is about 480 miles, and its greatest breadth, from east to west, about 400 miles. If estimated as a square, each side would probably be about 300 miles; so that its territory may be reckoned at 90,000 square miles, or about 6000 square miles more than the area of Great Britain.

Rajpootana is divided into eight principalities, besides the Batti country, or Hill States. The principalities are—Jypoor, Kotah, Boondee, Mewar (or Oodipoor), Marwar (or Joudpoor), Tonk, Jessulmir, and Bikanir. The city of Ajmeer, with a small territory surrounding it, belongs to the British.

The great chain of the Aravulli mountains stretches, in a north-eastern direction, through the greater part of Rajpootana, from the hilly country which connects it with the Vindhya mountains almost to the confines of Delhi. [ARAVULLI.] Nearly the whole of the country west of the Aravulli is a sandy waste, extending northward to the Ghurra branch of the Indus, and rising towards the south in a succession of steppes. In this barren territory are comprised the principalities of Marwar, Jessulmir, and Bikanir. A few oases occur, the largest of which are those in which the towns of Joudpoor, Jessulmir, and Bikanir have been built. To the north-east is the country of the Batti, the Hill States, which is separated from Lahore by the Sutledj. It is mountainous to the east, and encroached on by the desert to the west, but that part which is watered by the Gagor is very fertile, and produces corn, rice, sugar, and tobacco. To the east of the Aravulli mountains, and running nearly parallel with them, are the Chitore mountains. [HINDUSTAN, p. 214.] The country between the two ranges, which is from 60 to 100 miles broad, comprises the principalities of Mewar, Boondee, Tonk, and Jypoor. Kotah is on the east side of the Chitore mountains, in a rocky district.

Rajpootana, west of the Aravulli mountains, is for the most part little better than a desert; vast tracts of it consist of nothing but fine sand, on which not a blade of grass grows, and which the winds form into hills, sometimes 80 or 90 feet high, which continually change their form and position, so as to render it dangerous to pass across those parts of the country where they occur In some places the sand is more consolidated, and mixed with stones, and produces stunted bushes and coarse grass, which affords a scanty supply of pasturage to a few herds of camels and flocks of sheep in the season when the periodical rains occur, which however are of short duration and not abundant. A village is found here and there, consisting of huts made of straw, and surmounted by a conical roof. A few fields surround the huts, and these are enclosed by a hedge of stunted thorns. Nothing can be more wretched than the appearance of these villages and their miserable inhabitants. The aspect of the country somewhat improves as it rises towards the Aravulli mountains on the south-east: the oases become more frequent, and those large ones in which the great towns of Jessulmir, Bikanir, Nagore, and Joudpoor are situated, are tolerably fertile. The whole of Marwar indeed has a better soil and is in a better state of cultivation than the other principalities on the west of the Aravulli mountains, and as good as most parts of those on the east. There are numerous wells for irrigating the land, but as they are very deep, agriculture is expensive. Still the villages are in a good state; the corn looks well; the cotton is as fine as any in India; and the oxen and sheep are large and highly prized. There are no fruit-trees, but the water-melon is in great abundance. The principality of which Joudpoor is the capital is described in the article MARWAR.

Rajpootana, east of the Aravulli range, though its soil is of a similar sandy character to that on the west, is much more fertile and generally better cultivated. The periodical rains are more abundant and continue longer, and wells for the purpose of irrigating the land in the dry season are very numerous. These wells are of two kinds, common draw-wells and 'boolees.' The common draw-wells are often very deep, sometimes upwards of 200 feet. The manner of sinking them is curious, and perhaps the only one which would be practicable in a deep loose sand. A circular hollow tower of masonry, of a suitable diameter, and fifteen or twenty feet high, is constructed, and is left standing for a year or more, till it is well consolidated and set. The sinking of the well is then commenced, and the tower, being undermined, sinks gradually and steadily down, forming the casing of the well. When the top of the tower has reached the surface of the ground, more masonry is added, and thus the sinking proceeds till water is reached. The boolees are square pits, lined with hewn stone, fifteen or twenty feet across, and sixty or seventy feet deep. A flight of broad stone steps at one side descends to the water's edge. On the opposite side, at the top, is a pulley, as in the common wells, to draw up the water by oxen. The steps are used by persons who desire to wash themselves, or who have not rope enough to reach the water from the surface. Many of these boolees are very beautiful, with noble staircases, and with a kind of portico and pillars, richly wrought, as an approach to them. The practice of having steps down to the edge of the water arises from the religious observances of both Mohammedans and Hindus, which make washing an accompaniment of prayer. For irrigating the land the water is drawn up in a large leathern bucket, by oxen, over a rude pulley, and poured by the labourer into the 'gools,' or small channels, by which it is conducted to the fields. For ablution and other purposes an earthen jar is let down by a string from some of the galleries which are constructed on the flight of steps; those who have not this convenience are obliged to go down to the bottom with a skin, and bring the water up on their heads or backs.

The principality of Jypoor, with its capital, is described under JYENAGHUR. The small territories of Boondee and Tonk may be considered as included under the same head. The principality of Kotah, though small, is somewhat larger than the two preceding. It escaped the ravages of the Pindarees through the bravery and talents of the regent Zalim Singh, who by the employment of very limited means made his little territory a sort of Eden amid the surrounding misery which those ferocious robbers occasioned, and his court became an asylum for the unfortunate from every neighbouring principality. The town of Kotah is seated on the Chumbul, a branch of the Jumna, in 25° 12′ N. lat. and 75° 47′ E. long.

Mewar, though mountainous, is tolerably fertile, and produces all kinds of grain, sugar, indigo, cotton, and opium, but not enough of the last to export any. Good pastures are rare, and the cattle are smaller than in the neighbouring districts. Mewar suffered to a dreadful extent from the Pindarees, and has since only partially recovered from the desolation which they occasioned. Oodipoor, the capital of Mewar, is in 24° 34′ N. lat. and 73° 45′ E. long. It is seated in a mountainous district, and is a place of great strength, which can only be approached by three narrow defiles. Chitore, the former capital, having been taken by the Mohammedans, Oodipoor became the residence of the raja, or ranah, as he is called. This Hindu family is one of the oldest and purest in India, and its members have steadily resisted any attempts at intermixture either with Mohammedans or Hindus, always intermarrying with one another. The town of Chitore is situated in a rocky plain, in 24° 53′ N. lat. and 74° 45′ E. long., on the banks of the Bunnass, over which are the ruins of a long, lofty, and handsome stone bridge of eight Gothic arches, and one semicircular one in the centre. Chitore is a tolerably large town, with many pagodas and a meanly built bazaar. There is a beautiful minaret, dedicated to Siva. It is a square tower upwards of one hundred feet high, consisting of nine stories of white marble elaborately and tastefully sculptured, and surmounted by a cupola, the two highest stories projecting like balconies, so that it is smaller at the bottom than the top. A fortress of great strength and considerable extent, including the former palace of the ranah of Oodipoor, is situated on the top of a high rock close to the town.

Ajmeer, in 26° 28′ N. lat. and 74° 42′ E. long., is a moderate-sized town on the slope of a high hill. The houses are well built, and are mostly whitewashed. On the top of the hill is a remarkable fortress called Taraghur, which is a place of great strength, and is in most parts inaccessible. Ajmeer is resorted to by great crowds of Mohammedan pilgrims, who come here to visit the tomb of Shekh Kajah Mowûd Deen, a saint whose miracles are celebrated all over India. Just above the town of Ajmeer is a large lake, which was formed by the emperors of Delhi by damming up the outlet of an extensive valley, into which a number of rills were conducted. The lake is four miles in circumference in dry weather, and six during the rains. It affords the means of irrigation to a large district on its banks, supplies abundance of excellent water to the inhabitants of Ajmeer, and is full of fish. In 1818 the city of Ajmeer, with the surrounding district, was ceded to the British by Dowlet Rao Sindh, in exchange for a part of the territory of Malwa.

The other principal towns of Rajpootana which have not been noticed, are the following:—Bikanir, in 27° 58′ N. lat. and 73° 20′ E. long., a large town surrounded by a wall and ditch. The raja resides in a fort not far from the town, where there is an excellent spring of fresh water. Boondee, the capital of the principality of Boondee, is a small town on the side of a range of hills, on the summit of which is the raja's palace, a large stone edifice strongly fortified. Jessulmur. [HINDUSTAN, p. 221.] Tonk, on the Bunnass, in 26° 12′ N. lat. and 75° 47′ E. long. Kishengurh, in 74° 57′ N. lat. and 26° 38′ E. long., situated on a chain o granite hills, surrounded by walls of solid masonry, and with its castle on the mountain top. The raja's palace is a large but rudely-built fort on the banks of a fine pond. Wuerh is a large town surrounded by a high mud rampart well flanked by semicircular bastions, and with a wide but shallow ditch.

The principal rivers of Rajpootana are—the Chumbul [Hindustan, p. 215]; the Bunnass, an affluent of the Chumbul; and the Loony, or Salt River, which flows through Marwar, and disappears in the great salt marsh of the Runn.

The climate of Rajpootana is oppressively hot in summer, with parching winds. In winter it is colder than is pleasant in a country where fuel is everywhere scarce and extremely dear. The dried dung of camels or cows is almost universally used for fuel. Wood for burning or building is only grown in the south-east on the confines of Agra.

The vegetable productions of Rajpootana will be sufficiently known from the preceding descriptions. Of wild animals there are tigers, wolves, foxes, and wild hogs. East of the Aravulli mountains large herds of deer are occasionally met with, which are found to be extremely tame in a country where they are seldom used as food. There are considerable numbers of camels, oxen, and some buffaloes, large flocks of sheep, and an excellent breed of horses. The pea-fowl is regarded as a sacred bird, and is very abundant, as is also a beautiful green pigeon, and both are as tame as barn-door fowl. There are mines of iron and lead. Salt, cattle, camels, horses, and cheese are exported from Rajpootana by the ports of Gujerat. At Sambor, about forty miles west from Jypoor, is a large salt lake, which supplies the greater part of western and northern Hindustan with that useful article.

The inhabitants of Rajpootana are generally Hindus, but there is a considerable number of Mohammedans. Probably the whole population does not exceed 3,000,000, and consists principally of Rajpoots, Bheels, Jains, Jauts, and Mairs, besides the Mohammedans. The Rajpoots are Hindus. Till they came under the protection of the British they were little better than robbers, and were engaged in incessant warfare with each other: consequently the towns and many of the larger villages of Rajpootana are fortified, and generally placed in situations where they might be protected by a fortress on a rocky height. The Rajpoots, though more peaceable than they were, are not improved in other respects. They are described as idle, and addicted to intoxication, opium-eating, and other kinds of sensuality. The Bheels or Bhils [Hindustan, p. 221] are a wild race, who dwell generally in the mountain-fastnesses, whither they appear to have been driven by the Rajpoots. They bear a strong resemblance to the Puharrees of Rajmahal, and by similar treatment might probably be similarly improved. [Rajmahal Hills.] The Jauts are in considerable numbers in all parts of Rajpootana, and the whole of the Batti race may be considered as belonging to them. The Mairs are described in the article Aravulli.

The Rajpoot states were never properly subjected by the Mohammedan emperors; for though they were compelled to pay a tribute and furnish a certain number of mercenary soldiers, they continued in a state of half independence, and their continual revolts occasioned their principal cities to be several times destroyed. After the death of Aurungzebe, in 1707, Rajpootana continued nominally subject to the emperor of Delhi till 1748, when its chiefs became independent. Since then the desolating attacks of the Mahrattas have compelled them to place themselves under the protection of Great Britain. The rajas of Rajpootana are independent sovereigns, but an English officer commands its forces, and a garrison has been established at Ajmeer sufficient for its protection against its enemies, and also to keep the Rajpoot chiefs themselves in subjection.

(Tod's *Annals of Rajast'han*; Heber's *Narrative*; Mill's *History of British India*; *Maps* of the Society for the Diffusion of Useful Knowledge.)

RALEIGH, SIR WALTER, born in the year 1552, in the parish of Budley, on the coast of Devonshire, was the second son of Walter Raleigh and his third wife Catherine, daughter of Sir Philip Champernon and widow of Otho Gilbert, Esq. of Compton, Devon. Sir Humphry Gilbert, whose name is connected with the attempts to discover a north-west passage, was Sir Walter Raleigh's half-brother. In the retired neighbourhood of Budley, Raleigh received the rudiments of his education. He was entered a commoner of Oriel College, Oxford, in or about the year 1568, where, to use the words of Anthony Wood, 'he was worthily esteemed a proficient in oratory and philosophy.' In 1569 Raleigh accompanied his relative Henry Champernon with a volunteer corps to France in aid of the Huguenots. He served in France five years, and subsequently in the Netherlands, as a volunteer under the Prince of Orange. In 1576 Sir Humphry Gilbert obtained a patent to colonise any parts of North America not settled by the allies of England. Raleigh and Gilbert attempted a joint expedition, from which Raleigh returned unsuccessful in 1579. In the next year we find him commanding a company of the royal troops in Ireland during the rebellion raised by the earl of Desmond; he was one of the officers to whom the charge of murdering the Spanish prisoners was committed by Lord Deputy Gray. Some difference arising between the lord deputy and Raleigh, the latter was called upon to defend himself before the council, which he did with so much ability and grace that he gained the queen's ear. The romantic incident which tradition gives as the origin of his favour with the queen is well known. Elizabeth's partiality for handsome men was notorious, and Raleigh's personal recommendations were great. In two or three years from the time he was introduced at court he was knighted, made captain of the guard, seneschal of the county of Cornwall, and lord warden of the stannaries, and he received a grant of 12,000 acres of the forfeited estates of the Earl of Desmond, and a lucrative patent for licensing the vendors of wine in England. In 1583 Sir Humphry Gilbert sailed on a second expedition to North America, towards which Raleigh, now too much engaged at court to accompany it himself, subscribed 2000*l*. This attempt also proved abortive, and Gilbert perished on his return in a storm in which his ship foundered. Raleigh, undismayed, obtained for himself in 1584 a patent investing him with power to appropriate, plant, and govern any territories that he might acquire in North America. In 1585 the first body of colonists landed, under the government of Mr. Lane, in Virginia, so called in honour of the virgin queen. Harriott, a celebrated mathematician of the day, went out to survey the colony; his survey and report, and the introduction of the tobacco plant into England for the first time, were the only fruits of this attempt. [Harriott.] The misconduct of the colonists brought the hostility of the Indians upon them; and they re-embarked within a year on board Sir Francis Drake's squadron, who visited the Chesapeake on his homeward voyage. A second body went out in 1587; but this expedition also failed; the governor returned home for fresh forces, which were very difficult to obtain, as he arrived in the height of the preparations for the Spanish invasion. Raleigh however dispatched two small vessels, which were plundered at sea, and forced to put back; and when at length assistance was sent out, the colonists had been murdered by the Indians. In 1589, finding that his resources were unequal to the forming of a colony, he made over his patent to a company of merchants. Raleigh has been charged with neglecting those wretched men who were left among the Indians; but it appears from Purchas, that previous to the year 1602, he had sent five several times, at his own charges, to find these people, who were left in Virginia in 1587 (iv., p. 1653). This is a sufficient answer to the charge; but it is somewhat difficult to comprehend, why these few adventurers, in number about one hundred, should not have left the country where they were unable to maintain themselves, if they had the opportunity.

In 1587 Raleigh had been appointed one of the council of war to put the forces of the realm in the best order to withstand any invasion, and had command of the forces in Cornwall, of which county he was lieutenant-general. In July, 1588, after the Armada had passed up the Channel, he joined the British fleet with a small squadron, and greatly distinguished himself in the several engagements which ended in the discomfiture of the Spaniards. As a reward for these services he received an augmentation to his patent of wines, and the right to levy tonnage and poundage on them. In 1589 he accompanied the Lisbon expedition under Drake and Norris, the object of which was to place Don Antonio on the throne of Portugal. [Antonio.] In 1591 he sailed on an expedition to intercept the plate fleet, which was unsuccessful; and during his absence, the queen having discovered that an intrigue existed between Raleigh and Elizabeth, daughter of Sir Nicholas Throckmorton, one of the maids of honour, he was, immediately on his return, thrown into the

Tower. Raleigh married Miss Throckmorton, and on being released after a short confinement, retired to his estate of Sherborne in Dorsetshire. It was during this retirement that he formed his scheme for the discovery and conquest of El Dorado, that fabulous land of gold and unbounded wealth in the interior of South America, in the existence of which he firmly believed. On the 5th of February, 1595, Raleigh sailed from Plymouth with five vessels, and arrived at Trinidad about the end of March. He surprised the newly founded town of S. Josef, and took prisoner the governor, Don Antonio Berrio, from whom he extracted information which enabled him to ascend the Orinoco about 60 leagues, when he was forced to return. He arrived in England towards the end of the summer, 1595. Raleigh published an account of this voyage, under the sounding title of 'The Discovery of the large, rich, and beautiful empire of Guiana,' a work which had not the merit of any methodical arrangement of the matter, though it contains numerous vigorous passages, such as characterise the style of Raleigh. That Raleigh, though not without a disposition to the marvellous, actually believed all that he wrote, is hardly an admissible supposition. His regard to truth was never so strong as to prevent him from embellishing facts real or supposed, when he thought he could thus gain his ends. His restoration to favour at court, which took place shortly after, prevented any further prosecution of his designs on Guiana during the reign of Elizabeth. In 1596 he was employed, with the rank of rear-admiral, at the taking of Cadiz, where he greatly distinguished himself, and was severely wounded in the leg. In 1597 he took Fayal. About this time he was restored to his post of captain of the guard, and appointed governor of Jersey. He now became deeply engaged in court intrigue, and combined with Cecil, who afterwards crushed him, to destroy the Earl of Essex. He strongly urged Cecil, in a letter which appears among his works, to put down the earl; but it is doubtful whether this letter was written before or after the condemnation of Essex, as it has no date. Raleigh turned his influence with the queen to good account, by procuring a remission of the sentence for such of Essex's adherents as could afford to purchase his good offices. One of these, Mr. Littleton, paid Raleigh 10,000*l.* A transaction so shameless has no other apology than that it was not condemned by the opinion of the age. Bribery and corruption were universal, and we cannot expect a man of Raleigh's character to have had a higher standard of morality than his contemporaries. In the house of commons, of which he had been elected a member some years before, he made himself conspicuous by advocating principles far before his age: he maintained that every man should be left at liberty to employ his capital and labour where and how he liked, and that all restrictions on the trade in corn should be removed.

After the death of Elizabeth, Raleigh's fortunes fell. His haughtiness and rapacity, with the share he had in the ruin of Essex, had made him universally disliked; and Cecil, his former friend and associate, had completely poisoned James's mind against him. The post of captain of the guard was speedily given to another, and his wine-patent was withdrawn. An opening soon offered for a more serious attack. James had not long been seated on the throne before two or three plots against him were discovered. Among these was one named the Spanish or Lord Cobham's treason. Lord Cobham being intimate with Raleigh, the idea of his participation instantly suggested itself. Raleigh being examined before the council, declared his utter ignorance of any plot, but admitted that he was aware of some intercourse having taken place between Cobham and the Count D'Aremberg, the Flemish ambassador, and he recommended that La Renzi, one of that nobleman's suite, should be examined. This being made known to Cobham, he flew into a violent rage, declared that in all his intrigues he had been instigated by Raleigh, and that the money to be paid by Spain was to be lodged in the island of Jersey, of which island Raleigh was governor. He shortly afterwards fully and solemnly retracted all that he had said against Sir Walter, who was nevertheless committed to the Tower on a charge of high-treason, in July, 1602. While there he made an attempt at suicide by stabbing himself. In September, 1603, Raleigh was tried at Winchester, and found guilty. Doubts have frequently been thrown on the whole of the facts connected with Raleigh's accusation. That his conviction was procured by the power of his enemies, and that the verdict of the jury was not justified by the evidence, there can be no doubt; but the French ambassador, Beaumont, considered him morally guilty. It is certain that such a plot did exist for placing Lady Arabella Stuart on the throne, that the archduke knew of it, and that his minister Aremberg had corresponded with Cobham on the subject, and had promised a sum of money in support of it. It seems probable, indeed almost certain, that Raleigh was aware of Cobham's correspondence, although he might not be an actual participator in the plot. Some judicious writers are of opinion that he was even a principal mover in it. The best account of this celebrated trial is in Mr. Jardine's 'Criminal Trials' (*Library of Entertaining Knowledge*), to which we refer for some interesting remarks as to the supposed illegality of the procedings on Raleigh's trial, and on the state of the criminal law at that time.

Raleigh's conduct during his trial entirely changed the general feeling of dislike entertained towards him: an eyewitness observed, 'In half a day, the mind of all the company changed from the extremest hate to the greatest pity.' He was reprieved and sent to the Tower, where he was confined for thirteen years. His family suffered severely by his attainder: he had some years before conveyed his estate of Sherborne to his son, reserving his own life-interest, which was now forfeited, and a slight flaw being discovered in the deed of conveyance, Carr, the king's favourite, petitioned for and obtained the estate himself, reserving only 8000*l.* as a compensation for Raleigh's family. During his long imprisonment he turned to intellectual pursuits, and, with many minor pieces, executed his greatest work, 'The History of the World,' a project of such vast extent, that the bare idea of his undertaking it excites our admiration. As an author, Hume says, 'he is the best model of our antient style,' and Hallam observes that he is 'less pedantic than most of his contemporaries, seldom low, and never affected.' The first part of the 'History of the World, which is all that Sir Walter Raleigh completed, is contained in five books, commencing with the creation, and ending with the second Macedonian war, about 150 years before Christ. The following extract gives a good specimen of the style, while it accounts for his not continuing the work: 'O eloquent, just, and mighty Death! whom none could advise, thou hast persuaded: what none hath dared, thou hast done: and whom all the world hath flattered, thou only hast cast out of the world and despised: thou hast drawn together all the far-stretched greatness, all the pride, cruelty, and ambition of man, and covered it all over with these two narrow words, *Hic jacet!*'

'Lastly, whereas this book, by the title it hath calleth itself the "First part of the General History of the World," implying a second and third volume, which I also intended, and have hewn out; besides many other discouragements persuading my silence, it hath pleased God to take that glorious prince (Prince Henry) out of the world to whom they were directed, whose unspeakable and never enough lamented loss hath taught me to say, with Job, "Versa est in luctum cithara mea, et organum meum in vocem flentium."'

In 1615, Cecil being dead, and Somerset disgraced, Raleigh bribed the uncles of Buckingham, the new favourite, and induced Sir Ralph Winwood to recommend his project of opening a mine in Guiana. Upon this he was released conditionally. He equipped thirteen vessels for this expedition, which, from the magnitude of the undertaking and the celebrity of his name, attracted much attention, and Raleigh's ship was visited by all the foreign ambassadors. A writer in the 'Edinburgh Review' (No. cxliii., p. 82) gives an extract from a dispatch of Count Desmarests, the French minister, deeply implicating Raleigh's honour; it is to this effect: Raleigh 'resolved to abandon his country, to make the king of France the first offer of his services and acquisitions, if his enterprise, from which he confidently expected great results, should succeed.' The fleet reached the Coast of Guiana about the middle of November, 1617. Raleigh was so unwell that he could not ascend the Orinoco in person. Captain Keymis, the steady follower of Raleigh, led the exploring party, consisting of five companies of fifty soldiers each. A conflict took place with the Spaniards near St. Thomas, a small town recently built, in which the Spanish governor and Raleigh's eldest son Walter were slain; after which Keymis, having spent about twenty days in a fruitless search for the mine, and suffered considerable loss, returned to the fleet. Keymis, meeting with nothing but reproaches for his ill success, committed suicide. Raleigh sailed for Newfoundland to victual and refit; intend-ing afterwards possibly to return to Guiana, but certainly in the mean time to attack the Spanish plate fleet, if he could fall in with it. Before he reached Newfoundland the fleet separated, and on his arriving there, his own crew mutinied, and the majority declaring for a return to England, he was forced to accompany them. He arrived at Plymouth, in July, 1618, and was shortly after arrested by Sir Lewis Stukely, Vice-Admiral of Devonshire. He was conveyed to London, and on his journey made some ineffectual attempts to escape, and at Salisbury he feigned sickness. James, strongly urged by the king of Spain to punish Raleigh for his attack on St. Thomas, and being anxious to gratify that monarch, laid the case before his council, when it was argued that Raleigh, being under an unpardoned sentence for treason, was civilly dead, and accordingly could not be tried again. James therefore resolved to carry into execution a sentence sixteen years old, which had been followed by an imprisonment of thirteen years. He was brought up before the Court of King's Bench to receive sentence on the 28th of October, 1618, and beheaded the next morning, in the 66th year of his age. His conduct after his committal to the Tower, and up to the moment of his death, was so calm and resigned, as to move the sympathy even of his enemies.

Of Sir Walter Raleigh's character and personal appearance, Aubrey says, 'he was a tall, handsome, and bold man, but his næve was that he was damnable proud: he had a most remarkable aspect, an exceeding high forehead, long-faced, and "sour eie-lidded, a kind of pigge-eie."' In an age of magnificence in dress, Raleigh was conspicuous for his splendour. Of an original and versatile genius, an eminent commander by sea and land, a navigator and discoverer of new countries, an accomplished courtier, a statesman, a proficient in the mechanical arts, a poet of no mean ability, Sir Walter Raleigh was one of the most remarkable characters of an age celebrated for its eminent men. Little can be said in favour of his moral character: he was crafty and rapacious, and his conduct was not regulated by truth and probity; but he had kindly affections, and was much beloved by his dependants Besides his great work, he was the author of many smaller pieces on a variety of subjects, philosophical, political, naval, military, geographical, besides letters, and a collection of small poems. He had two sons by his wife: the elder was killed in South America; the second, Carew, who was born in the Tower, survived him.

(Birch and Oldys, *Life and Works of Sir W. Raleigh*; Tytler, 'Life of Sir W. Raleigh,' in *Ed. Cab. Libr.*; Jardine's *Criminal Trials*; Hume; Hallam, *Const. Hist.*; *Edinburgh Review*. No. cxliii.)

RALEIGH-TOWN. [CAROLINA, NORTH.]

RA'LLIDÆ, a family of birds belonging to the *Grallæ* of Linnæus, *Grallatores* of Illiger.

Brisson placed the *Rails* in the first section of his seventeenth order, with the *Lapwings*, the *Jacana*, the *Pratincole*, &c.

The genus *Rallus* of Linnæus consisted of Rails properly so called; and the species in the last edition of the 'Systema Naturæ,' as left by him, were *Crex aquaticus*, *Porzana*, *fuscus*, *striatus*, *torquatus*, *Philippensis*, *Benghalensis*, *Carolinus*, and *Virginianus*. The genus is placed in the order *Grallæ* (the fourth), between *Parra* and *Psophia*.

Latham also gave it a place among the *Grallæ* (his seventh order), between the *Pratincole* and the *Jacana*.

Lacépède arranged *Rallus* among his *Oiseaux de Rivage*, in his thirty-third order (birds with a straight and compressed bill), between the genera *Hians* and *Scopus*.

In M. Duméril's system *Rallus* is placed in the first family (*Pressirostres* or *Ramphostènes*) of his fifth order, *Echassiers*, between the *Jacanas* and *Oystercatchers* (*Hæmatopus*).

Illiger's *Macrodactyli*, belonging to his sixth order, *Grallatores*, include the genera *Parra*, *Rallus*, and *Crex*.

In Cuvier's fifth order, *Echassiers*, *Rallus* appears in its fifth family, *Macrodactyles*, between the *Kamichis* (*Palamedea*) and the *Fulicæ*.

M. Vieillot's second tribe (*Tetradactyli*) of his fourth order (*Echassiers*) includes, among many other families, the *Macrodactyles*, including the genera *Rallus*, *Porzana*, *Porphyrio*, and *Gallinula*. The *Macrodactyles* are placed between the *Macronyches* (*Jacana*) and the *Pinnatipèdes* (*Fulica*, *Phalaropus*, &c.).

M. Temminck places *Rallus* between *Scolopax* and *Gallinula*, in his thirteenth order (*Gralles*).

In M. de Blainville's system *Rallus* is also placed among the *Macrodactyles*, in the order *Grallatores*.

The late lamented Mr. Vigors, treating of the family *Scolopacidæ*, remarks that among the groups which originally composed the *Tringa* of Linnæus, the *Phalaropus* of Brisson may be distinguished, which, by its lobated feet and habits of swimming stands at the extremity of the *Scolopacidæ*, and leads the way to the succeeding family of *Rallidæ*. He then observes that the family of *Rallidæ*, composed of the Linnean genus *Parra*, with its congeners, *Palamedea*, Linn., and *Chauna*, Ill., together with *Rallus*, Linn., and *Fulica*, Linn., corresponds with the *Macrodactyles* of Cuvier. He conjectures that *Chionis*, Forst., comes into this family; but he adds that he knows too little of the group to speak with any confidence. The Linnean groups, he observes, are distinguished from the *Scolopacidæ* by their stronger bill and the greater length of the hind toe. They are also separated from the other birds of the order, and united among themselves, in his view, by the shape of their body, which is compressed and flattened on the sides, in consequence of the narrowness of their sternum. Mr. Vigors goes on to remark, that were we allowed to draw an inference from the analogical construction of other bodies, which move with the greater facility through the water in proportion as they assume this compressed and keel-like form, we might almost conclude that this structure, peculiar to the birds of the present family, facilitates their progress through that element, and is intended to counterbalance the deficiency in the formation of the foot, which separates them from the truer and more perfectly formed water-birds; and he alludes to Wilson's observation, who, when speaking of the *Rallus Virginianus*, mentions this character as conducive to the progress of the bird through the reedy marshes. 'It is certain,' continues Mr. Vigors, 'that the greater portion of these birds are excellent swimmers; and in such habits, as well as in the shortness of their *tarsi*, which is equally conducive to their powers in swimming, they are found to deviate from all the remaining groups of the order. They thus become an aberrant family, and lead directly, as has been before noticed, to the succeeding order of *Natatores*. The genus *Parra*, Linn., distinguished from *Rallus*, Linn., by the greater length of the toes, and more particularly by the length and straightness of the nails, is yet allied to that genus by the general structure of the bill. With *Parra* may be allied *Palamedea*, Linn., and *Chauna*, Ill., the *Parra chavaria* of the 'Systema Naturæ,' both of which seem to approach *Parra* in affinity, although the latter of them is so imperfectly known, that its situation cannot be decided with certainty. To *Rallus* succeeds *Crex*, Bechst., which, by its stronger and shorter bill, seems to lead on to *Gallinula*, Briss., from which genus, although agreeing with it in general appearance, it is decidedly separated from its terrestrial habits. *Gallinula* is set apart from the foregoing groups by the greater length of the toes and the dilatation of the upper mandible upon the forehead. This latter character is still further developed in the ensuing genus *Porphyrio*, Briss., where the base of the bill exhibits a considerable degree of robustness; and is also carried on to *Fulica*, which immediately adjoins *Porphyrio*. The species that compose the true *Gallinula* and *Porphyrio* may be observed to possess a narrow membrane on each side of the toes, which extends along their whole length straight and entire. We thus recognise the gradual approximation of these genera to the lobated foot of *Fulica* and *Podoa*, which unite the swimming *Waders* to the true web-footed *Natatores*. The dilatation of the upper mandible into a flat crown upon the forehead, which characterises the latter groups of this family, together with the same length of the toes, is found to exist in some species of *Parra*; and thus we are led back to the groups from which we commenced our observations on the family.' Mr. Vigors then enters the family of the *Charadriadæ* by the genus *Hæmatopus*. (*Linn. Trans.*, vol. xv.)

The *Macrodactyles* of M. Latreille form the sixth family of his fourth order, *Echassiers*, and consist of the *Jacana*, *Kamichi*, and *Chauna*.

M. Lesson makes the *Rallusinées*, the fourth family, according to him, of the *Echassiers*, consist of the genera *Jacana* (*Parra*), *Palamedea*, *Chauna*, *Glareola*, *Rallus*, *Crex*, *Gallinula*, *Porphyrio*, *Podoa*, and *Fulica*. The *Rallusinées* are placed between the *Scolopacidæ* and the *Charadriadæ*.

Mr. Swainson observes that the *Rallidæ* comprise the rails and water-hens, and constitute a very natural and well-marked family in the order of Waders. They have been designated, he remarks, by these familiar names, from their peculiarly harsh notes, and from assuming much of the appearance of the gallinaceous or rasorial birds; another proof, he adds, that the true analogies of nature are often perceived by the vulgar, although passed over by the scientific. 'The most permanent differences,' says Mr. Swainson in continuation, 'in their structure, when compared with the foregoing families (*Tringidæ* and *Charadriadæ*), is the great size of the leg and the length of the toes, particularly the hinder one: the body is very thin and unusually flattened; a structure particularly adapted to the habits of Rails, since they live for the most part in the tangled recesses of those reeds and aquatic vegetables which clothe the sides of rivers and morasses. They are for the most part solitary and timid birds, hiding themselves at the least approach of danger, but quitting their semiaquatic retreats in the morning and evening, to feed in more open spots: their flight, from the shortness of their wings, is very feeble, but they run with swiftness; and by the peculiarly compressed form of their body, are able to make their way through dense masses of reeds and high grass with so much facility as to escape even after being desperately wounded. The flesh of all these birds is delicate; and from living chiefly upon aquatic seeds and vegetable aliment, they may be considered as aquatic *Gallinacea*. The following are amongst the most obvious genera or subgenera which enter into the present group. Of these the Jacanas (*Parra*) are the most singular; they are distinguished by toes of such remarkable length, that by covering an enormous circumference, these birds can walk upon aquatic plants floating on the surface of the water with as much ease and security as if they made their way over hard ground. Most of the species are armed with a short and formidable bony spur on the shoulder of the wings; and the head is either partially naked or furnished with fleshy wattles. Several species occur in the hot latitudes of America, Africa, and Asia, but the genus is unknown in Europe. It is probable that the typical characters of the family are best seen in the genera *Rallus*, *Crax* (Crex?), *Gallinula*, and *Fulica*. The purple water-hens are most beautiful and majestic birds, in size nearly as large as a fowl; they have a very thick and strong bill, the corneous front being continued over the fore part of the head like a helmet. There is a fine species found in the marshes of Sicily; and another, almost exactly resembling it, in the distant regions of Australia. The genus *Podoa* probably belongs to the next order (*Natatores*).' (*Classification of Birds*, vol. ii.)

In the synopsis of the same work, the *Rallidæ* are placed between the *Tantalidæ* and *Scolopacidæ*, and consist of the following genera: *Parra*, *Porphyrio*, *Fulica*, *Rallus*, *Gallinula* (with the subgenus *Alecthelia*).

The genera of *Rallidæ* (which family he places between the *Scolopacidæ* and the *Phaleropodidæ*), enumerated by Prince Lucien Bonaparte in his 'Birds of Europe and North America,' consist of *Aramus*, Vieill., *Rallus*, Linn., *Ortygometra*, Leach, *Gallinula* (Briss., *Stagnicola*, Br.), *Fulica*, Linn., and *Porphyrio*, Ray.

The *Rallidæ*, in Mr. G. R. Gray's 'List of the Genera of Birds,' are the fifth and last family of the *Grallatores*, and immediately preceded by the *Palamedeidæ* (which embrace the genera *Parra*, *Chauna*, *Palamedea*, and *Alecthelia*). The order *Natatores* follows.

The following are the subfamilies and genera of Mr. G. R. Gray's *Rallidæ*:—

Subfamily I. Rallinæ.

Genera.—*Ortygometra*, Ray (*Rallus*, Linn., *Porphyrio*, Briss., *Crex*, Bechst., *Gallinula*, Lath.).

Porzana, Vieill. (*Rallus*, Linn., *Gallinula*, Lath., *Zapornia*, Leach).

Rallus, Linn. (*Gallina* (Gallinula?), Ray).

Ocydromus, Wagl. (*Rallus*, Forst.).

Subfamily II.

Porphyrio, Briss. (*Fulica*, Linn., *Gallinula*, Lath.).

Gallinula, Ray (*Fulica*, Linn., *Hydrogallina*, Lacép., *Stagnicola*, Brehm).

Fulica, Linn.

Subfamily III. Heliorninæ.

Heliornis, Bonn. (*Plotus*, Gm., *Podoa*, Ill., *Colymbus*, Bodd.).

Podica, Less. (*Heliornis*, Vieill., *Podoa*, Boie, *Rhigelura*, Wagl.).

We proceed to notice some of the leading forms of this family.

Rallidæ.

Feet very large. Bill in general short, and greatly compressed. Tail excessively short, nearly hidden by the covers. Hinder toe elevated. (Sw.)

Parra.

Generic Character.—*Bill* straight, slender, moderate. *Feet* very long. Toes and claws of enormous length; the latter straight or recurved. *Carpus* generally armed with acute spurs. (Sw.)

Mr. Swainson remarks that the *Jacanas* or *Parræ* are wading birds, somewhat analogous, both in structure and habits, to the European Water-hen; but in their native haunts, from not being disturbed, they are less shy. 'The number of these birds,' says Mr. Swainson, 'on the lakes of Brazil, the elegance of their movements, and their fearlessness of man, excite an interest in the traveller who journeys through regions ornamented alone by nature They are very light birds, and their long toes spreading over a wide surface enable them to walk on the floating leaves of aquatic plants with as much facility as if they were on land. In such situations their appearance is really delusive; for their pressure being sufficient to sink the surrounding leaf just below the surface, the birds actually appear to walk upon the water.' (*Zool. Ill.*, 2nd series.)

Geographical Distribution of the Genus.—Numerous in South America; some in India; and a few in Africa.

Example, *Parra Africana*.

Description.—Deep cinnamon above; crown of the head naked; throat white; breast fulvous; neck and quills black; spur on the wing obsolete.

Localities.—Africa, Abyssinia (Bruce), Mozambique (Salt), Western Africa (Swainson, on the authority of Ward), South Africa (Smith).

The strong bony spur with which the wing is armed in the typical species, becomes so small in *Parra Africana*, that it is hardly perceptible when the wing is closed. In another African species, *Parra Capensis*, the spur or spine has become a small tubercle. The African Jacanas may therefore be referred to the aberrant group of this genus. Dr. Smith only met with one individual of *Parra Capensis*, and he strongly suspects that it was in immature plumage. It was killed while seeking for its food upon some water-plants which coated the surface of a small river near Algoa Bay, and he has figured the bird standing on the leaf of a water-lily. He notices *Parra Africana* as the only other species of the group which has yet been found in Southern Africa, and states that it never ranges so far to the westward as the Cape Colony, though it is often found to the westward of Port Natal.

Parra Africana.

Porphyrio.

Generic Character.—Bill short, strong, high; the base dilated into a flat plate on the front of the head; the culmen arched. *Nostrils* large, basal, covered by a membrane, naked: the aperture terminal and oval. *Feet* very large. Toes without any lateral membrane. Claws large, slightly curved. (Sw.)

M. Temminck states that the *Porphyriones* live nearly like the Water-hens, to which they are the most closely approximated: like them, their habitual haunts are the fresh-waters; but the immense rice-fields (rizières) and marshes of the south equally serve them for an asylum and retreat. More inclined by their appetite to cereal grains and plants, than aquatic herbs, the Porphyrios frequent the land more than the Water-hens: they move with grace on the water, and run with elegance and swiftness on the land or over the plants which grow in the water. Their body is not so compressed nor so slender as that of the water-hens; their formidable bill, composed of a very hard substance, and nearly without a nasal fossa, which is covered by a membrane, serves them as an instrument for cracking the husks of grains and breaking the hardest stems; their feet, which they use to seize their food and convey it to their bill, are provided with very long toes, easily retractile, and with nails which bend also with some facility, which gives them a power of prehension. A brilliant plumage, where blue or a turquoise hue predominates, clothes the greatest number of the known species.

It is not clear what species of this genus was known to the antients, who held it in high estimation. The *Porphyrio* does not appear to have been sought after for any other purpose than that of keeping it alive; indeed Ælian states that he never heard of one being served at any banquet. Pliny (*Hist. Nat.*, x. 46 and 49) speaks of the Porphyrios as 'laudatissimi in Comagene,' and says that their bill and long legs are red; the Balearic Islands are also named by him as a place whence they were sent to Rome. He speaks of their peculiar mode of drinking, their soaking their food in water and raising it to their bills in their claws: 'Bibunt aves suctu, ex his quibus longa colla, intermittentes, et capite resupinato velut infundentes sibi. Porphyrio solus morsu bibit, idem est proprio genere, omnem cibum aqua subinde tingens, deinde pede ad rostrum veluti manu afferens.'

But there was another quality which was supposed to reside in the *Porphyrio*, which made it both a highly prized and dangerous inmate. The bird was considered as a kind of guard over the women of the house in which it was domiciled: it was believed that it took notice of adultery, and that if the crime was committed, it would give notice to the master of the house by making signs as if it wished to strangle itself. It is to this that the old quatrain alludes in the 'Portraits d'Oyseaux.'

'Porphyrion declare l'adultere
Fait au logis auquel on l'entretient:
Car à ces fins tous les semblans il tient
De se vouloir estrangler et deffaire.

Though, as we have observed, it is not certain what particular species was known to the antients, indeed there appears to have been more than one, we do not know why *Porphyrio hyacinthinus*, which, as we shall presently see, is very common in Sicily, and has a very wide range, should not have been kept in a state of domestication by them.

Example, *Porphyrio hyacinthinus* (*Pollo Sultano*, Savi).

Description.—(Both sexes.)—Bill fine red; legs and feet fleshy red; irides lake-red; cheeks, throat, sides of the neck, and chest turquoise-blue: remainder of the plumage deep dull indigo-blue, having the edges of the greater and lesser coverts of the wings lighter in colour and more brilliant; under tail-coverts white. (Gould.)

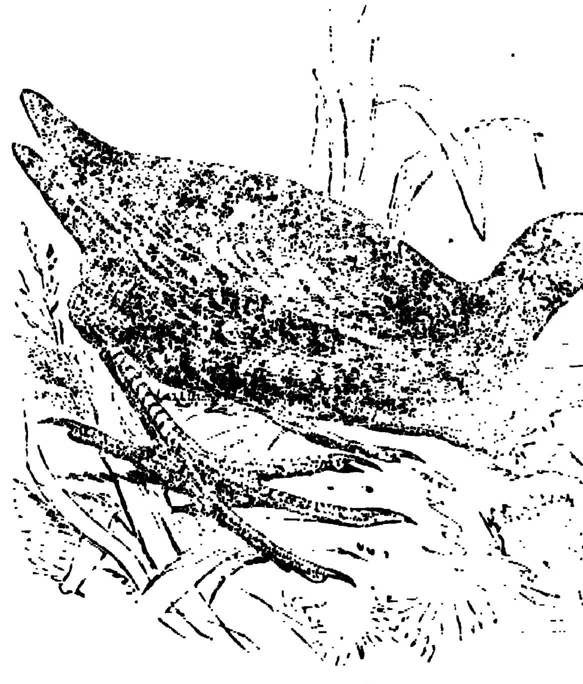
Young of the Year.—Belly, till the month of October, white; occiput yellowish-brown; median part of the head whitish; mantle bluish-ash. Feet reddish-olive. At the time of the moult, which takes place towards the end of October, individuals are found in a state of transition from the livery of youth to that of the adult: early in May the rich blue plumage is complete. (Temm.)

Geographical Distribution.—'Independently of the southern and eastern parts of Europe, the marshes of which are the places of constant resort for this beautiful bird, its range is extended,' says Mr. Gould, 'over a great portion of Africa to the south, and as far as the mountains of the Himalaya to the east. In Europe it is especially abundant in the Grecian Archipelago, the Levant, and the Ionian Islands: it is less common in Dalmatia and Sardinia. The southern provinces of Hungary and Russia and the borders of the Caspian Sea may also be enumerated among its European localities.' M. Temminck states that it is to be seen in many cities of Sicily (where, according to M. Cantraine, it is very common in the neighbourhood of Lentini), that it is not known in Dalmatia nor Calabria, and is rare in Sardinia; and that it is known in Catania under the name of *Gallo-fagiano*.

Food, Habits, Reproduction, &c.—Mr. Gould states that, like the Water-hen or Common Gallinule, this species dwells on the borders of rivers and in all marshy situations. In its food, he tells us, it is partly herbivorous, feeding on various kinds of marine vegetables; still, as the robust and hard character of its bill implies, it prefers hard seeds and grain, to which are added snails, frogs, and other aquatic animals.

'Although its form,' continues Mr. Gould, 'would seem to deny the fact, its actions and appearance on the land are both elegant and graceful. It is extremely quick in all its movements, running with ease and swiftness: and from the great expansion of its feet, it is enabled to pass with facility over soft oozy mud, aquatic herbage, &c.; but although much agility characterises this species on land, its aërial evolutions are heavy, and apparently performed with considerable difficulty.' M. Temminck states that it lives in the marshes where the water is not deep, and that its stupidity is such that when closely pursued it buries its head in the mud. M. Verneuil informed him that solitary individuals are sometimes found in Dauphiné: that of the museum of Grenoble was, he adds, killed in the marshes of Burgundy.

Porphyrio hyacinthinus breeds in marshes, much in the manner of the Common Gallinule, giving preference to the sedgy parts of the morass and partly inundated rice fields, where it constructs a nest of aquatic plants, and lays three or four white and nearly round eggs. (Gould.)



Porphyrio hyacinthinus.

Fulica.

Generic Character.—Bill as in *Porphyrio*, but more slender; the base straight; the gonys short and angulated. *Feet* very large; the toes margined with a lateral membrane, which is either narrow and of equal breadth or dilated into lobes. The natatorial type. (Sw.)

Example, *Fulica atra*.

Description.—Head and neck deep black; upper parts slaty-black; all the lower parts bluish-ash; frontal plate very wide, pure white; bill white, slightly tinged with rose-colour; iris crimson-red; feet ash-colour, tinged with greenish, but of a yellow or greenish-red above the knee.

The sexes do not differ, excepting that in the female and the young the frontal plate is less developed, and that in the latter, after the autumnal moult, the lower parts are slightly tinged with reddish. Before the moult, the frontal plate of the young is hardly apparent, and that and the bill are greenish-ash; all the lower parts are whitish-ash: in this state it is, according to M. Temminck, *Fulica Æthiops*, Sparm.; Gmel.

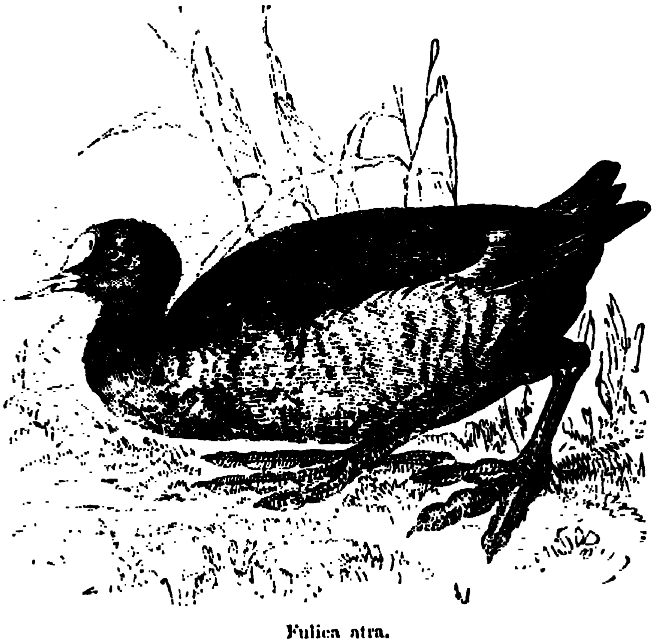
Varieties.—Pure white (very rare), or whitish with the colours weakly shown. Wings white; all the rest of the plumage as in ordinary. It is then *Fulica Leucorix*, Sparm.; and Gmel.

Fulica atra is the ***Foulque, Macroule***, or ***Morrelle*** of the French; ***Schwarzes Wasserhuhn*** of the Germans; ***Meir Koet*** of the Netherlanders; ***Folaga*** and ***Folacra*** of the Italians; ***Blas-klacka*** of the Swedes; ***Vand-Hoene*** and ***Bles-Hoene*** of the Danes; ***Iâr ddufr foel*** of the antient British, and *Coot* of the modern British. Some have thought that it is the κέπφος (Cepphus) of Aristotle,—quære tamen.

Geographical Distribution.—Europe, in marshes, lakes, and gulfs; very abundant in Holland and in the lakes of the interior of France; less numerous in Germany and Switzerland. Dr. Von Siebold and M. Bürger saw it in Japan.

Habits, Food, Reproduction.—'The coot,' says Mr. Gould, 'is indigenous to our islands, residing on all large sheets of water, but giving preference to those overgrown with rushes and margined with a belt of thick reeds and luxuriant vegetation.' Such is the meer or pond before William of Wykeham's palace at Bishop's Waltham, where they abound. In such haunts it builds, early in the spring, a strong and solid nest of rushes, grasses, and water-plants. The large nest thus constructed rises above the surface of the water, on the bottom of which, when shallow enough, the base of the nest sometimes rests. Its more frequent situation however is in the reedy and rushy tufts and rank vegetation of the water's edge, so as to be concealed. The eggs, which are brownish-white, spotted with dark brown, range from seven to ten in number. The young, when hatched, are clothed in a black down, and take water very soon. As winter approaches, the coots seek the open waters near the sea, and the mud-flats at Southampton are among the places visited by them in great numbers. The coot swims and dives admirably, but flies heavily and with effort. Its food consists of worms, slugs, aquatic plants, insects, &c.

Much cannot be said for it as an article of food, except when it is young, and then it requires much perseverance to get off the black down next to the skin.



Fulica atra.

Gallinula.

Generic Character.—*Bill* short, straight; the margins not inflexed. The cutting edges of the upper mandible folding over the lower. Gonys very short, angulated. Toes simple, without any marginal membrane. The rasorial type. (Sw.)

M. Temminck remarks that the Water-hens have their body very much compressed throughout its length. They live on land, but, like the *Ralli*, haunt fresh-waters. They swim with considerable celerity, dive with facility, run very fast on land, even where the herbage and reeds are thickest, and often, like the *Rails*, over the leaves and plants that grow at the surface of the water. Their food, like that of the *Rails* also, consists of insects and vegetables. They undergo perhaps a double moult, but the colours do not change. The young differ much from the adult; the plumage of the first does not attain its permanent colours till the expiration of a year. The males are only distinguished from the females by purer tints, and the frontal plates of the former are more extended.

Example, *Gallinula chloropus.*

Description.—(*Old Male.*)—Head, throat, neck, and all the lower parts slaty blue; upper parts deep olive-brown; external border of the wings, large longitudinal spots on the sides, and lower coverts of the tail, pure white; three or four of the feathers placed at the centre of the tail coverts deep black; base of the bill and large frontal plate bright red, point of the bill yellow; iris red; feet yellowish-green; on the tibia a naked circle of a fine red.

Old Female differs only in having the tints of the plumage a little less bright.

The Young, till their second autumnal moult, differ much from the old. The top of the head, the nape, the back, and rump are olive-brown; quills deep brown, terminated by bright brown borders; tail deep brown; throat, front of the neck, and a spot below the eye whitish; rest of the lower parts bright grey; point of the bill olive-green, blending into olive-brown at the base; iris brown; feet olive, but tinged with yellowish on the tibia.

Young of the Year.—More of the whitish around the bill; and the lower parts with the tints less bright. Individuals in a state of transition from one period of age to another have the frontal plate more or less large, coloured with red or yellowish.

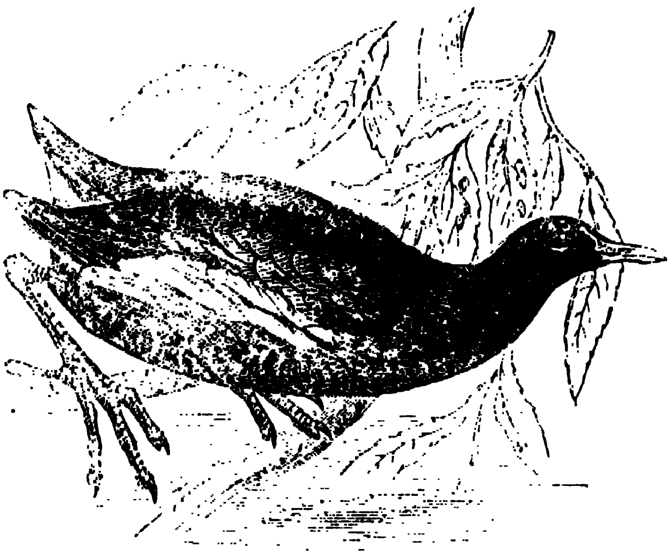
Such is M. Temminck's description, but Mr. Gould (*Birds of Europe*) says, 'One circumstance respecting this familiar bird appears to have escaped the notice of most ornithologists: we allude to the fact of the female being clothed in a dark and rich plumage, and having the base of the bill and the frontal shield of a bright crimson-red tipped with fine yellow; her superiority in these respects has caused her to be mistaken for the male, which, contrary to the general rule, is at all times clothed in a duller plumage, and has the upper surface more olive than in the female; the bill is also less richly tinted. We were first led to notice this fact in consequence of observing the birds sitting or rising from the nest to be those whose richly coloured bills had induced us to believe them to be males, and which the dissection of a great number of individuals has now fully proved to us to be the females. Besides this difference, the sexes vary in size, the female being about one fifth less than her mate.' The same author states that the young are clothed with a black down, and during the first autumn, although equal to the adults in size, have a much lighter plumage, the whole of the throat and under surface being then greyish white, and the bill and legs olive. The male has the bill red at the base, strongly tinged with olive; the centre of each feather on the flanks is blotched with a large oblong patch of white, which is the colour of the under tail coverts; irides red: tarsi and toes greenish olive: the former being encircled with a red mark immediately above the tarsal joint, called the *garter*.

This bird in its different states of plumage is the *Poule d'eau* of the French; *Gallinella* of the Italians; *Wasserhuhn*, *Grünfüssige Rohrhuhn*, and *Braune Meerhun* of the Germans; *Common Gallinule*, *Waterhen*, or *Moor hen* of the modern British; and *Dufriar* of the antient British.

Geographical Distribution.—Very wide. Mr. Gould states (and he is confirmed by others), that this species appears to be not only dispersed over the whole of Europe, but extends its range over the greater portion of Africa and India; and, like the Peregrine Falcon and Barn Owl, may be said to be universally distributed over the globe: 'it is even questioned,' adds Mr. Gould, 'whether those from tropical America, China, and the islands of the Pacific, which exhibit the most trifling marks of difference, should not be considered as identically one and the same species.' It was seen by Dr. Von Siebold and M. Bürger in Japan; and M. Temminck remarks that the African variety, which is also found in the isles of Sunda, has the anterior border of the wing reddish: the lower tail-coverts, which, in European, Asiatic, and Japanese individuals, are of pure white or Isabella colour, have a reddish tinge in the variety from Africa and the Sunda Isles, which is also somewhat less than European and Japanese birds, and has the frontal plate larger. The variety from the Sunda Isles is, according to M. Temminck, *Gallinula Orientalis* of Horsfield (*Linn. Trans.*, vol. xiii.). The only difference between the Japanese bird and that of Europe is the Isabella tint of the lateral under tail-coverts in the former: in the European variety those feathers are white.

Habits, Food, Reproduction, &c.—In our islands the haunts of the common Gallinule are rivers, meers, ponds, sedgy spots, and marshy places. The nest is formed of interlaced flags, weeds, &c., generally in the most concealed parts of the rushy rivulet or sedgy margined pond, and in it from five to nine pale yellowish-brown eggs spotted with red are deposited. Incubation continues for three weeks. The young are exposed to many enemies, for their parent has not only to guard them against birds of prey and the smaller carnivora, rats, &c., but against the attacks of the pike. The food consists of aquatic insects, mollusks and worms, seeds and water herbage. The flesh of a water-hen in good season, after having had the advantage of a neighbouring wheat or barley stubble, is well flavoured, juicy, and sapid. The sportsman who is not well acquainted with their habits, often leaves them behind perched among the boughs of the trees or shrubs that overhang the water or closely adjoin it; for these birds when hard pressed not uncommonly get up into such retreats till the danger is passed. On its feet it is lively and not ungraceful: on wing it is heavy and slow.

Some of the African Gallinulos, figured by Dr. Smith (*Gallinulæ dimidiata* and *Jardinii* for instance), present certain differences which would appear to warrant subgeneric distinction.



Gallinula chloropus.

Rallus.

Generic Character.—*Bill* lengthened, slender. Both mandibles in general slightly curved, and with their margins considerably inflected beyond the nostrils. The tenuirostral type. (Sw.)

Example, *Rallus Aquaticus.*

Description.—Throat whitish; sides of the head, neck, breast, and belly leaden ash-colour; all the feathers of the upper parts red-brown, marked in the middle with deep black; sides deep black transversely striped with white bands; lower coverts of the tail white; bill red but clouded with brown at the point and above; feet brown flesh-colour; iris orange.

The Young of the Year have the middle of the belly of a red brown, and the abdomen is blackish-ash without the white bands. (Temm.)

Mr. Gould remarks that the sexes are alike in plumage, but that the male is generally the largest. M. Temminck observes that they undergo a double moult, but that there is no marked difference between the two liveries.

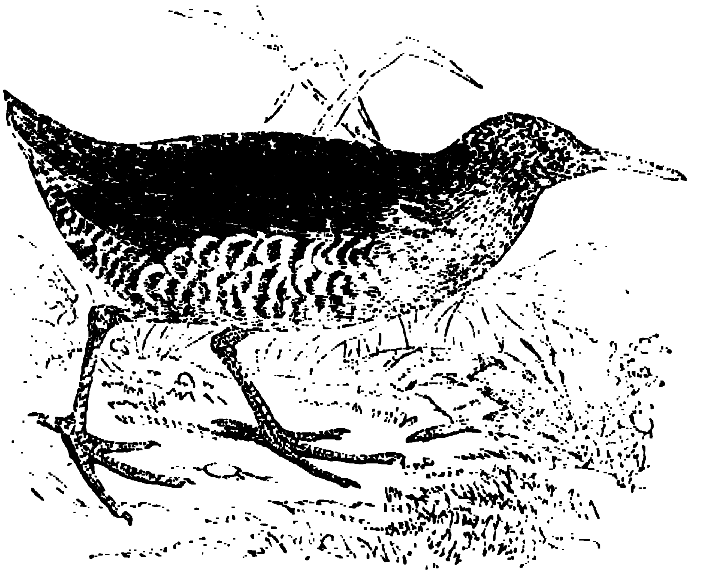
This species is the *Rale d'Eau* of the French; *Porciglione*, *Merla aquarola*, and *Merla d'Acqua* of the Italians; *Wasser Ralle* of the Germans; *Water-rail*, *Ridcock*, *Bilcock*, *Velvet runner*, *Brook-runner*, and *Brook-Ousel* of the modern British; and *Cwtair* of the antient British. It is the *Rasle noir* of Belon, who gives the following synonyms:—'Ορτυγομήτρα* (Ortygometra), *Matrix Cothurnicum*, *Ralla*, *Rasle*, *Ralle*, *Roy et mere des Cailles*, and *Re de Quaglie.*

Geographical Distribution.—Europe, over which it is dispersed generally, but it is is more particularly abundant in the low districts of Holland, Germany, and France. In our islands it is more plentiful than is generally believed from its very shy and retired habits. Dr. Von Siebold and M. Bürger saw the bird in Japan.

Habits, Food, Reproduction, &c.—'Except when closely pressed,' says Mr. Gould, 'the Water-Rail seldom takes to flight, but evades pursuit by quietly yet quickly traversing the bottoms of thickset reed-beds and banks overgrown with luxuriant vegetation bordering the sides of pools and ditches, where it finds a covert through which its slender and compressed form enables it to pass with the greatest facility; besides which it possesses the power of swimming and diving, both of which materially aid its escape. Without denying the possibility of this bird being migratory, we have the strongest reason to believe that numbers remain with us during the whole of the year, frequenting during the summer season fen-land, morasses, ponds, and ditches, about which it incubates; resorting, on the approach of winter, to the sides of our large streams and rivers. Its nest is composed of rushes and vegetable fibres closely concealed among herbage, at a little elevation from the water; its nidification in fact closely resembles that of the Moor-hen. Its eggs* are of a yellowish-white colour, marked with spots of red-brown. Its food consists of worms, snails, soft insects and their larvæ, which abound in swampy places; vegetable substances also form a part. The young, when first excluded from the egg, are covered with black down, and are observed to be in perfect possession of the powers of swimming, and providing for their own safety and subsistence, remaining however under the parent's care and protection.'

The Water-rail is a delicious bird for the table. The writer of the old quatrain in the 'Portraits d'Oyseaux,' thus alludes to its celerity in running:—

> 'Le Rasle noir par les ruisseaux habite,
> Et est cogneu en diverse contrée
> D'un bon coureur la vistesse est monstrée,
> Quand on le dit, comme un Rasle, aller viste.'



Rallus aquaticus.

Crex.

Generic Character.—*Bill* shorter than the head, thick at the base, subcultrated, compressed; the culmen gradually deflecting from the forehead to the point of the bill; lateral furrow of the upper mandible broad, and occupying more than half its length; angle of the under mandible bending upwards: both mandibles of an equal length. *Nostrils* concave, lateral, linear-ovoid, pierced in a membrane occupying the mandibular furrow in the middle of the bill. *Wings* armed with a spine, and having the second and third quill-feathers the longest. *Plumage* soft, thick, and open in texture. *Legs* strong, of mean length, with the lower part of the tibiæ naked. *Feet* fourtoed, three before and one behind. *Toes* long, slender, and cleft to their base, without any lateral membrane, hind toe resting on the ground. *Claws* arcuate, compressed, and pointed. (Selby.)

Mr. Selby remarks that the *Crakes* hold an intermediate station between the *Rails* on the one hand and the *Gallinules* on the other, from the first of which they are distinguished by a shorter, thicker, and more angular bill, and from the latter in wanting the extension of the lateral membrane that borders the soles of the toes, as well as the naked callous skin (or plate) that occupies the forehead. By Linnæus, he observes, they were included in his genus *Rallus*, but Latham afterwards, under his system, transferred them to the genus *Gallinula*, in which he has been followed by Temminck. Mr. Gould has also placed the Land-Rail (*Rallus Crex*, Linn.) under *Gallinula*, but with regard to the smaller and spotted Crakes he has adopted Leach's generic name of *Zapornia*, which is supposed to be a transmutation of *Porzana*, *Rallus Porzana* being the Linnean name of one of those species. Bechstein separated the Crakes from *Gallinula* and *Rallus*, under the generic name of *Crex*, which included the *Spotted Crakes* (*Zapornia*), and many ornithologists have adopted his view. Mr. Selby, who is one of those who follow Bechstein, states that the habits of the Crakes are similar in many respects to those of *Gallinula* and *Rallus*, the former being of a shy and solitary disposition, living concealed in the thick herbage of meadows or marshy districts. 'They have,' says Mr. Selby, 'the same thin and compressed shape of body, and they run with a skulking gait, and with great quickness, seldom taking wing unless suddenly surprised, or when forced to it by persevering pursuit, of course with the exception of the times of their annual migration. They feed on worms and insects, as well as vegetables and seeds. Their flight is awkward and heavy, and they hang their legs, when only on wing for a short distance. All the British species are migratory, and come under the designation of summer visitants. The plumage of both sexes is nearly alike, differing only in the colours of the male bird being purer and brighter in tint. The young however are very different, and do not acquire the matured plumage till they undergo the second general moulting.'

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* Aristot., 'Hist. Anim.,' viii., c. 12.

* From six to ten. Tem.

Example, *Crex pratensis*, Bechst. (*Rallus Crex*, Linn.).

Description.—A large ash-coloured eyebrow, prolonged upon the sides of the head; all the feathers of the upper parts blackish brown in the middle, bordered laterally with ash-colour, and terminated with reddish; the long feathers which extend on the quills entirely bordered by a large band of olive-reddish; coverts of the wings of a rusty red; quills reddish externally; throat, belly, and abdomen white; breast olive ash; sides reddish, striped with white; upper mandible brown, lower whitish; iris reddish-brown; eyebrows flesh-colour; feet flesh-colour or reddish-brown.

The *Young* have the tints less vivid, but brighter, with some white spots.

This is the *Rale de Genet*, or *Roi des Cailles* of the French; *Re di Quaglie* of the Italians; *Wiessen-Knarrer* and *Wachtel-Konig* of the Germans; *Kwartel Koning* of the Netherlanders; *Vagtel-Konge*, *Aker-Rixe*, and *Skov-Snarre* of the Danes and Norwegians; *Land-Rail*, *Corn-crake*, *Daker-hen*, *Bean-crake*, and *Corn-drake* of the modern British; and *Rhegen yr yd* of the antient British. Belon gives the following synonyms:—'Ορτυγομήτρα ἄλλη, *Ortygometra altera*, *Ralla*, *Re de Quaglie*, *Ralle rouge*, or *Ralle de Genet*.

Geographical Distribution.—'The Land-rail,' says Mr. Gould, 'appears to be extensively spread over the whole continent of Europe; it is very abundant in Holland, and not uncommon in France and Germany. It is a migratory species, arriving with us about the latter end of April or the beginning of May, when it scatters itself in pairs over the whole of the British Isles.'

Food, Habits, Reproduction, &c.—Worms, snails, insects and their larvæ, seeds, and grain form the food of the Land-rail. It is very fond of grasshoppers. 'Its habits,' says Mr. Gould, 'are extremely shy and retiring, selecting for its places of abode grassy meadows, fields of young corn, ozier-beds, and marshy grounds, seldom allowing itself to be seen; and were it not for the peculiar note of the male, which consists of a singular grating monotone—sometimes sounding as if beneath one's feet, and again appearing as if uttered at a distance,—its presence would not be betrayed. In these its favourite places of resort and concealment it carries on the process of incubation, constructing its nest on the ground, and occasionally on small hillocks, the nest being composed of slender flags or grasses; the female laying from eight to twelve eggs, rather less than those of the moor-hen, to which, in the markings, they bear some resemblance, of a yellowish-white, covered with dull rust-coloured spots. The young when hatched are covered with a blackish down, and are soon able to follow the parent birds, attaining, by the commencement of the shooting-season, nearly the adult size and plumage.' Its southward migration commences in October, when it passes over to the Continent.

After it is once flushed, it is almost impracticable to force the Land-rail to take wing a second time, until it has run through every part of the cover that holds it. It is easily shot when on wing, though its flight is generally very short, for it flies heavily, and with the legs hanging down. It will run before a dog with the greatest rapidity, and very frequently escapes by trusting to its legs alone.

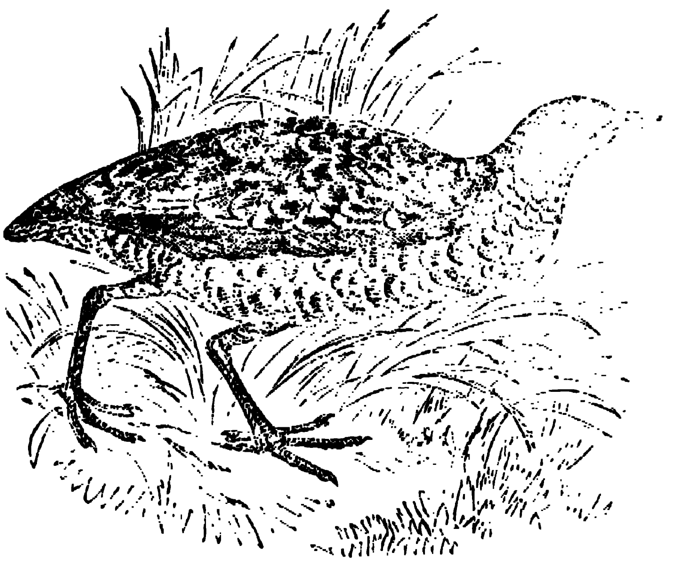
When dressed [illegible]he same day on which it is killed, with the trail in, it i[illegible]ery delicious, and it has always been highly esteemed for the table.

In the old quatrain under the cut of the Land-rail we read,—

> 'Au Ralle noir est ressemblant ce Ralle,
> Sinon de bec, de grandeur et coleur.
> A la Perdrix il ne cede en valeur,
> Mesme leur chair est en bonté egale.'

In the 'Northumberland Household Book,' *Reys* are among the birds admitted to his lordship's table, and are charged at twopence each, the same price as that of a quail, and double that of a teal. Drayton too, in his 'Polyolbion' (twenty-fifth song), notices—

> 'The Rayle, which seldom comes but upon rich men's spits.'



Crex pratensis.

The reader will find the other European Crakes beautifully figured in Mr Gould's grand work 'The Birds of Europe;' of these, *Zapornice Baillonii* and *pusilla* were observed by Dr. Von Siebold and M. Bürger, in Japan.

RALPH, JAMES, was born at Philadelphia, in what year is not recorded, and passed the earlier part of his life there as a schoolmaster. In 1725 he came to England in company with his townsman Benjamin Franklin. 'We have not learned,' says the writer of his article in the 'Biographia Dramatica,' 'what was then the immediate object of his pursuit, but it was probably something in the public offices dependent on the court; for he soon became a frequenter of the levees, and attached to some great men to whom his abilities recommended him.' It may be doubted notwithstanding if he had any other employment for some time except writing in the newspapers. In the first book of the 'Dunciad,' published in 1728, Pope mentions him as one of the 'gazetteers,' who are described in a note as 'a band of ministerial writers, who, on the very day their patron (Walpole) quitted his post, laid down their paper, and declared they would never more meddle in politics.' The lines in the text are—

> 'And see, thy very gazetteers give o'er,
> Even Ralph repents, and Henley writes no more.'

This same year appeared Ralph's first separate and acknowledged literary performance, a poem, entitled 'Night.' It is to this work that Pope alludes in the third book of the 'Dunciad,' where he exclaims—

> 'Silence, ye wolves, while Ralph to Cynthia howls,
> And makes night hideous; answer him, ye owls!'

To this passage is appended a very abusive note, in which Ralph, whose name is stated to have been inserted after the first editions of the poem, is denounced as the author of 'a swearing piece called "Sawney,"' which, it appears, was an attack upon Pope and his two friends Swift and Gay. 'This low writer,' it is added, 'attended his own works with panegyrics in the journals, and once in particular praised himself highly above Mr. Addison, in wretched remarks upon that author's account of English poets, printed in a London journal, September, 1728. He was wholly illiterate, and knew no language, not even French. Being advised to read the rules of dramatic poetry before he began a play, he smiled and replied, 'Shakspere writ without rules.' He ended at last in the common sink of all such writers, a political newspaper, to which he was recommended by his friend Arnall [manager of the 'British Journal'], and received a small pittance for pay.' In reply to this, his admirer in the 'Biographia Dramatica' says, 'It is very certain that he was master of the French and Latin languages, and not altogether ignorant of the Italian; and was in truth a very ingenious prose writer, although he did not succeed as a poet.' His dramatic writings are—'The Fashionable Lady, or Harlequin's Opera,' produced at the theatre in Goodman's Fields, in 1730, with some success, in the rage for such entertainments which had been recently excited by the 'Beggar's Opera;' 'The Fall of the Earl of Essex,' a tragedy (altered from the 'Unhappy Favourite' of John Bankes), brought out at the same house in 1731; the 'Lawyer's Feast,' a farce, performed at Drury Lane in 1744; and the 'Astrologer,' a comedy, 'once acted,' says the title-page, 'at Drury Lane,' also in 1744. 'The Astrologer' was only an alteration of an old play, called 'Albumazar,' written by a Mr. Tomkis, of Trinity College, Cambridge, in 1615. 'Ralph, in his advertisement,' says the 'Biographia Dramatica,' 'complains that ten years elapsed before it could obtain the favour of a representation; that he was not unknown to the great, nor destitute of private friends; and having devoted the most serious of his studies to the service of the public, he had some reason to expect the public favour; yet that the receipts of the house upon the first night were but twenty-one pounds; and when the manager risked a second, to give the author a chance for a benefit, he was obliged to shut up his doors for want of an audience.' Both the play and Ralph's dramatic reputation would thus appear to have been very bad. Another of his latter publications, which is described as 'a very excellent and very entertaining performance,' a tract, entitled 'The Case of Authors,' is stated to have also had 'some relation to the stage;' it was probably an argument for the protection of dramatic copyrights; though his own do not seem to have been in much danger of infringement.

Most of Ralph's publications however were political pamphlets on the topics of the day; and he is also supposed to have continued to be an active contributor to the public journals to the end of his life. He attached himself latterly to the faction of the Prince of Wales, and frequent mention of him may be found in Bubb Dodington's 'Diary.' Horace Walpole, in his 'Memoirs of the Last Ten Years of George II.,' writes, under date of 2nd of June, 1753:—'A new anti-ministerial paper appeared, called "The Protester," supported at the expense of the duke of Bedford and Beckford [the alderman], and written by Ralph, a dull author, originally a poet, and satirized in the 'Dunciad;' retained, after his pen had been rejected by Sir Robert Walpole, by Dodington and Waller: but much fitter to range the obscure ideas of the latter than to dress up the wit of the former: from them he devolved to the Prince of Wales in his second opposition, and laboured long in a paper called 'The Remembrancer,' which was more than once emboldened above the undertaker's pitch, by Lord Egremont and others. Ralph's own turn seemed to be endeavouring to raise mobs by speculative ideas of government: from whence his judgment at least may be calculated. But he had the good fortune to be bought off from his last journal, the 'Protester,' for the only paper that he did not write in it.' Other accounts make him to have been 'taken off' by a pension towards the end of Sir Robert Walpole's time, in consequence of having then made himself so formidable to the ministry. The death of Prince Frederick (in March, 1751) was an annihilating blow for the moment to Ralph, as well as to his patron Dodington, who had promised to make him his secretary if he should live to have the seals of secretary of state for the southern department, which the prince had engaged to give him (*Diary*, July 18 and 19, 1749); but it is said that he obtained a considerable sum from the government for the surrender of an important manuscript written by the prince, or under his royal highness's direction, which had come into his possession. On the accession of George III., he got another pension, which however he did not long enjoy, for he died of gout at his house in Chiswick, 24th January, 1762, followed in a few weeks by his only daughter, in her eighteenth year, of the same disease. Ralph had more talent and perhaps more principle too than the hostile notices we have quoted would allow him. Of his political pamphlets, the only one which is now remembered is his answer to the duchess of Marlborough's famous 'Account of her Conduct,' an octavo volume of four hundred and sixty-seven pages, entitled 'The Other Side of the Question, or an Attempt to rescue the Characters of the Two Royal Sisters, Queen Mary and Queen Anne, out of the hands of the D——s D—— of ——, in which all the Remarkables in her Grace's late Account are stated in their full strength, and as fully answered; the conduct of several noble persons is justified; and all the necessary lights are thrown on our Court history from the Revolution to the change in the ministry in 1710: in a Letter to her Grace, by a Woman of Quality,' Lond., 1742. This is by far the ablest and most important of the various answers and defences which her grace's publication drew forth; and some things in it appear to have been supplied by the family of the late earl of Oxford (the lord-treasurer Harley). Ralph is also the author of another anonymous work (published indeed without the name of either printer or bookseller) entitled 'Of the Use and Abuse of Parliaments; in Two Discourses, viz. 1, A General View of Government in Europe; 2, A Detection of the Parliaments of England from the year 1660,' 2 vols. 8vo., Lond., 1744. In an advertisement we are informed that the first of the two discourses, which however fills only seventy-eight pages of the first volume, is from the pen of Algernon Sydney. The rest of the book is a hasty performance, and of little value. But his principal work, also anonymous, is his continuation of Guthrie's History, entitled a 'History of England during the Reigns of King William, Queen Anne, and King George I.: with an Introductory Review of the Reigns of the Royal Brothers, Charles and James; in which are to be found the seeds of the Revolution. By a Lover of Truth and Liberty:' 2 vols fol., Lond., 1744-46. Notwithstanding a systematic and very unfair depreciation of King William, which runs through a great part of it, this work is written with considerable spirit and acuteness, and contains many new facts and corrections of the views of preceding historians. It has decidedly risen in reputation with our increasing knowledge of the times of which it treats.

RAM. [SHEEP.]

RAMA. [VISHNU.]

RAMADHA'N, the ninth month in the Arabian calendar, and a sort of Lent observed by the Mohammedans, in obedience to the express command of the Koran. During this month every good Moslem is bound to fast from the first appearance of day-break until sunset. He must abstain from eating, drinking, smoking, smelling perfumes, and all other unnecessary indulgences or pleasures of a worldly nature; even from intentionally swallowing his spittle. He is allowed to bathe himself, but it is on condition that he is not to plunge his head under water, lest some drops should enter his mouth or ears. Some even are so scrupulous that they will not open their mouths to speak, for fear of breathing the air too freely. To make amends for this extreme rigour, Moslems generally feast all night till day-break, though the more rigid begin the fast again at midnight. As the Ramadhán happens at different seasons of the year, the fast is very severe when it falls in summer; the abstinence from drinking being most painfully felt. Persons who are sick, or on a journey, and soldiers in time of war, are not obliged to observe the fast during this month, but then they should fast an equal number of days at a future time. Fasting is also dispensed with in the case of nurses and pregnant women. The prophet even disapproved of any persons keeping the fast of Ramadhán, if not perfectly able; and he desired no man to observe it so strictly as to injure his health or disqualify himself for necessary labour, which is frequently the case among the lower classes of people. The reason given by the Mohammedan theologians for the month of Ramadhán having been fixed upon for this purpose is, that the prophet received his first revelation in that month; others pretend that it was chosen by Mohammed from its being generally spent by the antient Arabs in revelry and mirth and excessive drinking.

RAMÂYANA. [Sanscrit Literature.]

RAMAZZI'NI, BERNARDO, was born at Carpi, near Modena, in 1633. He studied medicine at Parma, and took his doctor's degree there in 1659. He practised successively at Carpi and at Modena; and when the university of the latter place was instituted, he was appointed professor of the theory of medicine by the duke Francis II. In 1700 he was invited to the second professorship of medicine at Padua, and in 1708 was raised to the principal chair there, though blind and so infirm that he earnestly desired to decline that honour. He died in 1714.

Ramazzini was a frequent writer and a very warm controversialist both in medical and literary subjects. His first work was a series of letters in a controversy with Moneglia, a physician of Modena, in which both engaged with much more acrimony than medical judgment, but in which Ramazzini certainly supported the best view of the case, which respected the removal of the placenta after childbirth.

The works by which Ramazzini is now best known are 'De morbis artificum diatriba,' Mutin., 1770, and 'De abusu chinæ-chinæ diss. epist.' The former was translated into several languages, and among them into English in 1725. It contains a fair description of all the diseases to which each class of artificers is liable, as far as they were then known, the descriptions being very carefully drawn up both from the writings of his predecessors and from his own observations. The latter was intended to detract from the extravagant reputation which the Peruvian bark at that time enjoyed, and though it may now be evident that the author fell into the opposite extreme, and degraded that medicine far below its real merits, the work was probably in its day productive of much benefit. The whole of Ramazzini's writings were published collectively at Cologne, in 1689, at London in 1717, and at several other places at nearly the same time. They are still held in high repute by the Italian physicians, who seem to regard their author with as much reverence as they did, who in his life-time honoured him with the title of Hippocrates III.

RAMBEH, the Malay name of a fruit described by Mr. Jack as being common in the peninsula of Malacca, but unknown at Bencoolen, while the *Choopa*, which is nearly allied to it, is abundant at the latter, but is not found at the former place. The fruit is that of a tree called *Pierardia dulcis*, of the natural family of Sapindaceæ. Another species of the same genus is called *P. sapida*, from its also yielding an edible fruit. It is found in the district of Tippera, to the eastward of Calcutta, and also in China, where it is cultivated for its agreeable fruit, according to information obtained by Dr. Roxburgh from Chinese gardeners. It is remarkable that it should there be called Lutqua, as it is called Luteo by the Hindus on the eastern frontier of Bengal.

RAMBERVILLER. [Vosges.]

RAMBOOTAN, a fruit of the Malayan archipelago, belonging to the same genus (Nephelium, of the natural family of Sapindaceæ) as the Chinese fruits Litchee and Longan. The fruit is about the size of a pigeon's egg, something like that of the Arbutus, but larger, and of a brighter red. It has a skinny red coat covered with soft spines, whence is derived its Malay name from *rambut*, 'hair.' Within the covering is enclosed a small quantity of semi-transparent rich subacid pulp, which forms the edible part of the fruit, and covers a large kernel. Mr. Marsden describes the flavour of this fruit as rich and of a pleasant acid, but Mr. Crawford states that it is not much esteemed. It has been cultivated in this country in a rich light loam in hothouses.

RAMBOUILLET. [Seine et Oise.]

RAMILLIES, or **RAMELIES,** a small village, with about 600 inhabitants, in the province of South Brabant, 13 miles north of Namur and 26 south-east of Brussels, in the present kingdom of Belgium. A victory was obtained in its vicinity, on the 23rd of May, 1706, by the allied army under the Duke of Marlborough and the Dutch field-marshal Van Ouwerkerk, over the French and Bavarians commanded by Marshal Villeroi and the Elector of Bavaria. This battle is considered as the most complete and successful exemplification of the military talents of Marlborough. The numbers were about 60,000 men on each side, but the French generals were no match for Marlborough: and the day ended in a complete victory on the part of the allies, who lost only 4000 men, while the loss of the French was 15,000. The immediate evacuation of Flanders by the French was the result of this battle.

RAMIRO II., son of Ordoño II., succeeded to the throne of Asturias and Leon by the abdication of his elder brother Alfonso IV., surnamed 'el Monge' (the monk), who, in 930, renounced the vanities of the world, and retired into the monastery of Sahagun. Ramiro rendered himself illustrious by his wars with the Mohammedans, from whom he wrested many considerable districts and towns, thereby extending the limits of the small kingdom founded by Pelayo. [Pelayo.] Soon after his accession to the throne (932), Ramiro, profiting by the internal troubles which at that time agitated the Mohammedan empire, made a successful irruption into the states of Abd-er-rahmân, the reigning khalif, destroying Madrid, Talavera, and other towns; and when Al-mudaffer, the khalif's uncle, arrived at the head of considerable forces to revenge the outrage, he defeated him with dreadful carnage on the banks of the Duero, not far from the town of Osma. In 938 Ramiro turned his victorious arms to another quarter; he invaded Aragon, or *Thagher* (as that province was then called by the Arabs), and laid siege to its capital, Saragossa, which he would have reduced if the governor had not hastened to pay him homage and acknowledge himself a feudatory of his crown; though these advantages seem to have been counterbalanced by the victory gained by the Mohammedans over his troops in 938, near a village called Sotuscobas. Ramiro was again victorious in a battle fought under the walls of Ramora, in which the Moslems, according to their own authorities, lost upwards of 40,000 men, and Abd-er-rahmán himself was well nigh taken prisoner. [Moors.] Ramiro, like most of his predecessors, had often to contend with internal enemies. Scarcely had he ascended the throne when his brother Alfonso, growing weary of monastic life, forsook his cell, and with a considerable force hastened to Leon to reclaim his throne. He was there invested by Ramiro, who compelled him to surrender, and again consigned him to his monastery, where he was soon after deprived of his eyes, a species of punishment much in use among the Visigoths of Spain. The dependent count of Castile, Ferran-Gonzalez, and one Diego Nuñez, a count also in the same province, next revolted against Ramiro, but he marched against them, seized their persons, and confined them to a dungeon; though he soon after pardoned them and even married his eldest son Ordoño to Urraca, daughter of Ferran. Ramiro died on the 5th of January, 950, after a glorious reign of nearly twenty years. Some time before his death he abdicated in favour of his son Ordoño, and, assuming the penitential garb, passed the remainder of his days in religious retirement.

RAMISERAM. [Ceylon.]

RAMLER, C. W. [Germany, vol. xi., p. 196.]

RAMPHA'STIDÆ (*Toucans*), a family of scansorial birds.

Belon, at the end of the twenty-eighth chapter of his third book 'De la Nature des Oyseaux vivants le long des rivières, ayants le pied plat, nommez en Latin *Palmipedes aves*' (A.D. 1555), gives a wood-cut of the bill of a Toucan, which, from the black patch at the end of it, was probably that of *Ramphastos Toco*. He describes the bill as belonging to a bird of the *terres neufues*, which possesses that organ half a foot long, large as a child's arm, pointed and black at the tip, white elsewhere, and notched some little on the edges, hollow within, and so finely delicate that it is transparent and thin as parchment. Its beauty, he observes, has caused it to be kept in the cabinets of the curious. He further says that he has not seen the bird, but that he suspects that it is *de pied plat*, and therefore he has placed it with the River Birds.

In the 'Portraits d'Oyseaux' also, the cut of this bill is placed at the end of 'Le Second Ordre des Oyseaux au pied plat.' Above it appears the following description:—

'Bec d'un Oyseau aquatique apporté des terres neufues.'

"Si quelqu'un avoit fait un corps d'oyseau à ce bec sans avoir grosseur suffisante, qu'on le juge fait à discretion, car nous l'avons mieux aymé laisser ainsi, que luy en feindre un.'

Below the cut is the following quatrain,—

> 'Ce bec est gros comme le bras d'un enfant,
> Creux par dedans, transparent comme verre;
> Tenue et leger, venu d'estrange terre,
> Noir par le bout, et blanc au demeurant.'

The birds themselves do not seem to have found their way to England a century after the date of Belon's works; for, in the Museum Tradescantianum, the standard collection of the time, and which, from the list of contributors, appears to have been the great receptacle for all curiosities, we read, under the division (No. 2) of *Beaks* or *Heads*,—'Aracari of Brazil, his beak four inches long, almost two thick, like a Turke's sword' (A.D. 1656). But if the bird itself had not been brought forward, it is probable that Tradescant knew its nature, from the description above given. Petiver (tab. xliv., f. 13) gives a figure of the bird complete, and though it bears all the marks of the imperfect state of the arts at that time, as far as engravings of subjects of natural history are concerned, it is substantially correct, and the arrangement of the toes right. The description is, 'Toucan Surinamensis niger, ex albo, flavo, rubroque mixta,' taken from a Dutch painting, in Mr. Clark's collection: this does not exactly agree with any authors I have yet read.' Willughby (tab. xx) gives a figure of a Toucan (*Ramphastos Toco*, probably) under the name of 'the Brazilian Pie of Aldrovandus, the Toucan of Marcgrave and others, the Xochitenacatl of the Mexicans: Nieremb.' The figure is incorrect about the feet, to which three anterior toes are given, though Willughby, who cites Thevetus, Faber, Dal Pozzo, Lerius, Oviedo, and John de Laet, was evidently aware of the true organization, viz. two toes before and two behind.

Brisson placed the form in his thirteenth order, consisting of those birds which have four toes, two before and two behind.

Linnæus arranged the Toucans (*Ramphastos*) at the head of the second division (*pedibus scansoriis*) of his second order, *Picæ*.

Latham also assigned to them the same situation.

Lacépède places *Ramphastos* at the head of the second order (*Bec dentelé*) of his *Grimpeurs*, or climbers.

Duméril arranged the form at the head of the *Levirostres*, or *Cénoramphes*, the second family of his third order, *Grimpeurs*.

The *Scansores* form the first order in the method of Illiger, and *Ramphastos* and *Pteroglossus* appear at the head of the second family, *Serrati*.

In Cuvier's system the Toucans are arranged in his third order, *Grimpeurs*, between the *Anis* [CROTOPHAGA] and the Parrots [PSITTACIDÆ].

The *Zygodactyli* are the first tribe of M. Vieillot's second order, *Sylvicolæ*, and the Toucans are placed in the fourth family, *Ptéroglosses*, between the Jacamars and Barbets.

M. Temminck arranges the form in the first family of his fifth order, *Zygodactyles*.

Mr. Vigors (*Linn. Trans.*, vol. xiv.) opens his section on the *Scansores* with a remark on the deviation which had been observed in the *Buceridæ* (arranged by him among the *Conirostres*) from the more perfect formation of the foot, as preparing us for the still more considerable deviation that takes place in the same particular among the *Scansorial Birds*. 'Besides the approach which we have just noticed in the *Buceridæ* [HORNBILLS] to the imperfect form of the scansorial foot, we may perceive that the large and disproportionate bill of that family is carried on to the *Ramphastidæ*, the first family of the *Scansores* that meets our attention. There is seldom perhaps a surer guide to relations of affinity and analogy than common observation; and a trivial or provincial name often anticipates the more correct and scientific views of the naturalist. In seeking for the immediate point of junction between the two tribes now before us, we are in this manner directed at once to the object of our search; a scansorial genus, belonging to the family of *Ramphastidæ*, the *Scythrops* of Dr. Latham, being designated, as may be seen in the collection belonging to the Linnean Society, by the denomination of *Psittaceous Hornbill*.' [SCYTHROPS.] The family of *Ramphastidæ* then, according to Mr. Vigors, consists of the genera *Ramphastos*, Linn., and *Pteroglossus*, Ill., which fill up the same station in the New World that *Buceros* maintains in the Old. To these genera he adds *Scythrops*, as equally assimilated to both groups, and thus supplying their place in Australasia. *Scythrops*, in the opinion of Mr. Vigors, unites the *Ramphastidæ* with the larger and more prominent billed *Cuculidæ*, which meet it at the other extremity of the tribe. The connection of *Ramphastos* with the *Psittacidæ* is, he observes, not so evident. [PSITTACIDÆ, vol. xix., p. 85.]

The *Grandirostres* form the fifth family of the *Grimpeurs*, the third order in the system of M. Latreille, and embrace the genera *Toucan* and *Aracari*, which are placed between the *Proglosses* (Wryneck, Woodpecker, &c.) and the *Galliformes* (*Musophaga*, *Touraco*).

The Toucans appear as the fifteenth family of the Normal Birds of M. de Blainville, and are placed between *Buceros* and *Picus*.

In M. Lesson's 'Projet' the *Ramphastidæ* succeed the *Picidæ*, and are the last family of the first tribe of his *Insessores* or *Grimpeurs* (*Heterodactyles*).

Mr. Swainson (*Classification of Birds*) states that the fourth family of the *Scansores*, or *Climbing Birds*, is represented by the *Toucans*, whose enormous bills give to these birds a most singular and uncouth appearance. He remarks that their feet are formed, like those of the parrots, more for grasping than climbing, and that they do not appear to possess the latter faculty; but as they always live among trees, and proceed by hopping from branch to branch, their grasping feet are peculiarly adapted to such habits. He adds that the intervals between the toucans and the parrots is not perhaps so great as between the latter and the woodpeckers; but that still it is sufficiently wide to make us believe that one if not two of the intervening types are wanting. The genera of the *Ramphastidæ*, according to Mr. Swainson, are *Ramphastos*, *Pteroglossus*, *Aulacorhynchus*,* and *Scythrops*.

Mr. G. R. Gray (*List of the Genera of Birds*) makes the *Ramphastidæ* the first family of the *Scansores*, with the following genera:—

Rhamphastos, Linn. (*Pica*, Gesn., *Tucana*, Briss.).

Pteroglossus, Ill. (*Ramphastos*, Linn.).

Selenidera, Gould (*Ramphastos*, Linn.; *Pteroglossus* Wagl.).

Aulacoramphus (*Ramphastos*, Linn.; *Pteroglossus*, Sw.; *Aulacorhynchus*, Gould).

Scythrops, Lath.

Mr. Gould, in his beautiful monograph of the *Ramphastidæ*, divides them into two great sections:—

1. Caudâ breviore, quadratâ: rostro maximo. *Nigri, gutture caudæque tegminibus discoloribus.* RAMPHASTOS. (The *Toucans*.)

Of these Mr. Gould records eleven species, arranged in four subdivisions, according to the distribution of their colouring.

2. Caudâ longiore, graduata; rostro majore. *Viridescentes: capite, gastræo, tegminibusque caudæ superioribus in plurimis discoloribus.* PTEROGLOSSUS. (The *Araçaris*.)

Of these Mr. Gould records twenty-two species, arranged in twelve subsections, also according to the distribution of their colouring.

Geographical Distribution, Habits, &c.—The *Toucans* and *Araçaris* appear to be restricted in their geographical range to tropical America, and there they live retired in the deep forests, mostly in small companies. Their flight is straight but laborious, and not graceful; while their movements, as they glide rather than hop from branch to branch, are elegant.

Mr. Broderip gives the following account of the habits of a Toucan (*Ramphastos erythrorhynchus*) in captivity. Mr. Swainson, who had seen the Toucans in their native forests, had previously informed Mr. Broderip that he had frequently observed them perched on the tops of lofty trees, where they remained as if watching. This circumstance, joined to others connected with the remains of food found in the stomachs of such as were dissected, induced Mr. Swainson to suspect that these birds were partly carnivorous, feeding upon eggs and young birds, as well as fruits and berries; and that while perched upon these high trees, the Toucans were in fact busily employed in watching the departure of the parent birds from their nests. Mr. Swainson could never catch the Toucans in the fact, nor did anything appear in his dissections to determine with certainty on what they fed. Mr. Such informed Mr. Broderip that he had seen these birds in Brazil feed on the Toucan-berry, that he had frequently observed them engaged in quarrels with the monkeys, and that he was certain that the Toucans fed also on eggs, nestlings, &c.

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* Employed in botany.

On the 23rd of November, 1824, the late lamented Mr. Vigors had spoken at the Zoological Club of a living Toucan, which was then exhibited in St. Martin's Lane. Mr. Vigors stated that the bird had been fed on a vegetable diet; but that the proprietor had told him that on the occasion of a young Canary bird having escaped and gone near to the Toucan, the latter appeared more than usually excited, that thereupon the barrier between them was removed, and that the Toucan instantly seized and devoured the Canary bird. On the next day Mr. Broderip went to the place where the Toucan was exhibited, and thus describes what he saw:—

'After looking at the bird which was the object of my visit, and which was apparently in the highest state of health, I asked the proprietor to bring up a little bird, that I might see how the Toucan would be affected by its appearance. He soon returned, bringing with him a goldfinch, a last year's bird. The instant he introduced his hand with the goldfinch into the cage of the Toucan, the latter, which was on a perch, snatched it with his bill. The poor little bird had only time to utter a short weak cry; for within a second it was dead, killed by compression on the sternum and abdomen, and that so powerful that the bowels were protruded after a very few squeezes of the Toucan's bill. As soon as the goldfinch was dead, the Toucan hopped with it, still in his bill, to another perch, and placing it with his bill between his right foot and the perch, began to strip off the feathers with his bill. When he had plucked away most of them, he broke the bones of the wings and legs (still holding the little bird in the same position) with his bill, taking the limbs therein, and giving at the same time a strong lateral wrench. He continued this work with great dexterity till he had almost reduced the bird to a shapeless mass; and ever and anon he would take his prey from the perch in his bill, and hop from perch to perch, making at the same time a peculiar hollow clattering noise; at which times I observed that his bill and wings were affected with a vibratory or shivering motion, though the latter were not expanded. He would then return the bird to the perch with his bill, and set his foot on it. He first ate the viscera, and continued pulling off and swallowing piece after piece, till the head, neck, and part of the back and sternum, with their soft parts, were alone left: these, after a little more wrenching, while they were held on the perch, and mastication, as it were, while they were held in the bill, he at last swallowed, not even leaving the beak or legs of his prey. The last part gave him the most trouble; but it was clear that he felt great enjoyment; for whenever he raised his prey from the perch he appeared to exult, now masticating the morsel with his toothed bill and applying his tongue to it, now attempting to gorge it, and now making the peculiar clattering noise accompanied by the shivering motion above mentioned. The whole operation from the time of seizing his prey to that of devouring the last morsel lasted about a quarter of an hour. He then cleaned his bill from the feathers by rubbing it against the perches and bars of his cage. While on this part of the subject it may be as well to mention another fact, which appears to me not unworthy of notice. I have more than once seen him return his food some time after he had taken it to his crop, and, after masticating the morsel for awhile in his bill, again swallow it; the whole operation, particularly the return of the food to the bill, bearing a strong resemblance to the analogous action in ruminating animals. The food on which I saw him so employed was a piece of beef, which had evidently been macerated some time in the crop. While masticating it, he made the same hollow clattering noise as he made over the remains of the goldfinch. Previous to this operation he had examined his feeding-trough, in which there was nothing but bread, which I saw him take up and reject; and it appeared to me that he was thus reduced from necessity to the above mode of solacing his palate with animal food. His food consists of bread, boiled vegetables, eggs, and flesh, to which a little bird is now added about every second or third day. He shows a decided preference for animal food, picking out all morsels of that description, and not resorting to the vegetable diet till all the former is exhausted.

'It is said that the nerves are very much expanded within the internal surface of the bill in these birds; and independently of the sensual enjoyment which the Toucan above mentioned appeared to derive from palating his prey, I have observed him frequently scratching his bill with his foot, which may be considered as furnishing additional evidence of the sensibility of this organ. While taking his prey he never used his foot for the purpose of conveying it either to his bill or elsewhere. The bill was the sole vehicle and the organ actively employed; the foot merely confined the prey on the perch.

'But there is yet another of the peculiarities of this bird which cannot be passed over in silence. When he settles himself to roost, he sits a short time with his tail retroverted, so as to make an acute angle with the line of his back; he then turns his bill over his right shoulder, nestling it in the soft plumage of the back (on which last the under mandible rests), till the bill is so entirely covered that no trace of it is visible. When disturbed, he did not drop his tail, but almost immediately returned his bill to the comfortable nidus from which on being disturbed he had withdrawn it. He broke a short time ago some of his tail-feathers, and the proprietor informed me that before that accident the bird when at roost retroverted his tail so entirely that the upper surface of the tail-feathers lay over and came in contact with the plumage of the back; so that the bird had the appearance of a ball of feathers, to which indeed when I saw him he bore a very considerable resemblance. The proprietor informs me that he always roosts in the same way.' (*Zool. Journ.*, vol. i.)

In a subsequent volume (ii.) Mr. Vigors gives the following interesting account of a Toucan, *Ramphastos Ariel* (Vig.), which he kept in a state of domestication for many years:—

'With respect to the manners of my bird, I can add but little to the very accurate and interesting account of those of a species nearly allied to it, which has appeared in a preceding number of this journal.* I have not allowed it to be indulged in that disposition to animal food which so strikingly belongs to this family. I find in fact that it thrives sufficiently well upon a vegetable diet; and I fear that if it should once be allowed any other, it would be difficult to restrain its inclination for it within moderate limits. Eggs are the only animal food with which it has been supplied since it came into my possession. Of these it is particularly fond, and they are generally mixed up in his ordinary food, which consists of bread, rice, potatoes, German paste, and similar substances. He delights in fruits of all kinds. During the period when these were fresh, he fed almost exclusively on them; and even in the present winter months he exhibits great gratification in being offered pieces of apples, oranges, or preserved fruits of any description. These he generally holds for a short time at the extremity of his bill, touching them with apparent delight with his slender and feathered tongue; and then conveying them by a sudden upward jerk to his throat, where they are caught and instantly swallowed. His natural propensity to preying upon animals, although not indulged, is still strongly conspicuous. When another bird approaches his cage, or even a skin or preserved specimen is presented to him, he exhibits considerable excitement. He raises himself up, erects his feathers, and utters that "hollow clattering sound" noticed by Mr. Broderip, which seems to be the usual expression of delight in these birds; the irides of his eyes at the same time expand, and he seems ready to dart upon his prey, if the bars of his cage permitted his approach. On one occasion, when a small bird was placed by chance over his cage at night, he showed great restlessness, as if aware of the neighbourhood of the bird; and he would not be composed until the cause of his anxiety was discovered and removed.

'When in his cage, he is peculiarly gentle and tractable, suffers himself to be played with, and feeds from the hand. Out of his cage, he is wild and timid. In general he is active and lively; and, contrary to what might be expected, from the apparent disproportion of the bill and the seemingly clumsy shape of the birds of this genus, as they are usually set up or represented in figures, his appearance is not only graceful, but his movements, as he glides from perch to perch, are light and sylph-like; so much so as to have suggested to an intelligent friend who witnessed them the specific name which I have ventured to assign him. He keeps himself in beautiful plumage, his lighter colours being strikingly vivid, and the deep black of his upper body in particular being always bright and glossy. For this fine condition he seems to be much indebted to his fondness for bathing. Every day he immerses himself in cold water with apparent pleasure, even in this severe weather; and in no respect indeed does he appear to suffer by the transition from his own warm climate to our uncongenial atmosphere.

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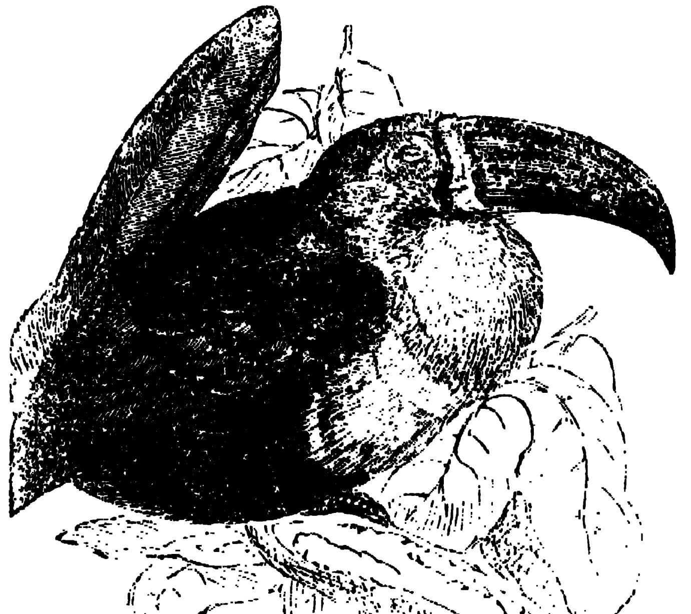
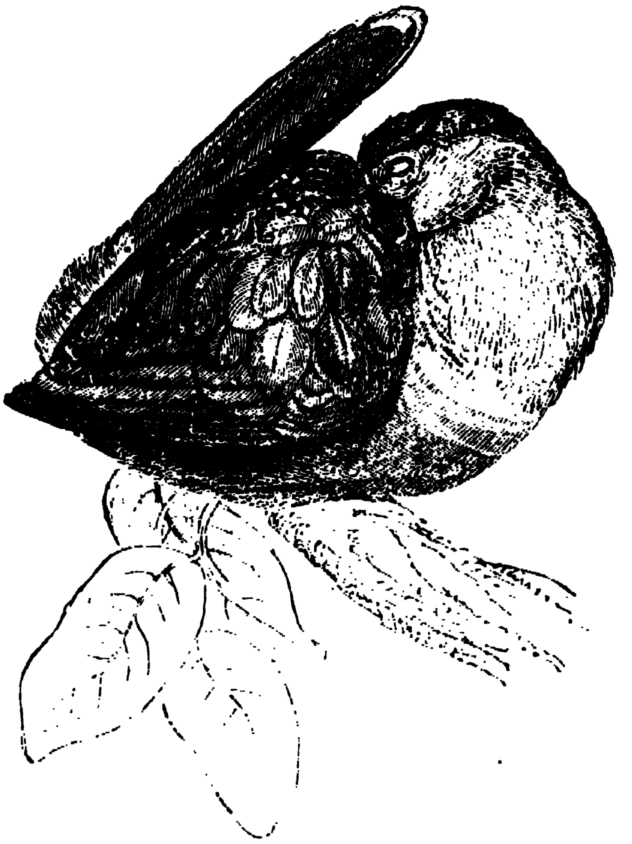
* Mr. Broderip's account, above given.

'Besides the "hollow clattering noise," as my friend Mr. Broderip so expressively terms the usual sounds of these birds, he utters at times a hoarse and somewhat discordant cry when he happens to be hungry, and to see his food about to be presented to him. On such occasions he stands erect, raising his head in the air, and half opening his bill as he emits this cry. These are the only sounds I have heard him utter; and in neither can I say that I have detected any similarity, or even approach, to the word Toucan, as has sometimes been asserted, and from whence the trivial name of the genus has been supposed to originate. Neither have I been able to verify another observation which has been advanced respecting these birds, that the bill is compressible between the fingers in the living bird. The bill, notwithstanding the lightness of its substance, is firm, and capable of grasping an object with much strength. The mode in which Mr. Broderip describes his Toucan as having broken the limbs of the bird which he was about to devour, by "a strong lateral wrench," sufficiently shows that the bill is not deficient in power. Indeed I generally observe that my bird takes what is offered him rather by the sides than by the point of his bill: and I suspect that much of the powers of that member are centred in this lateral motion. The serration of the edges also may be supposed to tend to these peculiar powers. The manner in which he composes himself to rest is represented in the accompanying plates. Since the cold weather has commenced, he has been brought into a room with a fire, and the unusual light seems to have interfered with his general habits; he does not go to rest as early or as regularly as was his custom: and he sometimes even feeds at a late hour. During the warmer months however, when he was more free from interruption, his habits were singularly regular. As the dusk of the evening approached, he finished his last meal for the day; took a few turns, as if for exercise after his meal, round the perches of his cage: and then settled on the highest perch, disposing himself, almost at the moment he alighted on it, in the posture represented, his head drawn in between his shoulders, and his tail turned vertically over his back.



Toucan at roost; first stage.

'In this posture he generally remained about two hours, in a state between sleeping and waking, his eyes for the most part closed, but opening on the slightest interruption. At such times he would allow himself to be handled, and would even take any favourite food that was offered him without altering his posture further than by a gentle turn of the head. He would also suffer his tail to be replaced by the hand in its natural downward posture, and would then immediately return it again to its vertical position. In these movements the tail seemed to turn as if on a hinge that was operated upon by a spring. At the end of about two hours he began gradually to turn his bill over his right shoulder, and to nestle it among the feathers of his back, sometimes concealing it completely within the plumage, at other times having a slight portion of the culmen exposed. At the same time he drooped the feathers of his wings and those of the thigh-coverts, so as to encompass the legs and feet; and thus nearly assuming the appearance of an oval ball of feathers, he secured himself against all exposure to cold.'



Toucan at roost; second stage.

All are now agreed that in a state of nature the *Ramphastidæ* are omnivorous. Mr. Swainson (*Classification of Birds*) says, 'The apparent disproportion of the bill is one of the innumerable instances of that beautiful adaptation of structure to use which the book of nature everywhere reveals. The food of these birds principally consists of the eggs and young of others, to discover which nature has given them the most exquisite powers of smell:' and he notices the size of the bill as ancillary to this development.

Mr Gould, who alludes to the papers of Mr. Broderip and of Mr. Vigors, states that in their choice of food the Ramphastidæ are perfectly omnivorous: and although their elastic bill and delicately feathered tongue would lead us to conclude that fruits constituted the greatest proportion of their diet, we have abundant testimony that they as readily devour flesh, fish, eggs, and small birds, to which, in all probability, are added the smaller kinds of reptiles, caterpillars, and the larvæ of insects in general.

The incubation of most if not all of this family takes place in the holes of trees, a habit that was very early known. We find Willughby, after quoting Faber for proof that in the structure of their feet, &c., the toucans resemble the woodpeckers, 'to the genus whereof the toucan, as Faber in this place proves, doth undoubtedly belong,' continuing thus: 'for it not only hath a like situation of toes, but also in like manner hews holes in trees to build its nest, as Fryer Peter Alvaysa, and other Indians and Spaniards, who had long lived in America, told Faber for a certain truth; and Oviedus, in the forty-third chapter of his summary of the history of the West Indies, published in Italian, writes, adding that he thinks there is no bird secures her young ones better from the monkeys, which are very noisome to the young of most birds. For when she perceives the approach of those enemies, she so settles herself in her nest as to put her bill out at the hole, and gives the monkeys such a welcome therewith that they presently pack away, and glad they escape so. From this quality of boring the trees, this bird is by the Spaniards called *carpintero*, and by the Brazilians *tucataca*, in imitation, I suppose, of the sound it makes.' The feathered structure of the tongue is also there noticed.

Mr. Gould remarks that the true toucans, unlike many of the araçaris, offer no sexual difference in the colour of the plumage; but the females are rather less than the males in all their proportions. He adds that the young of both genera assume at a very early age the adult colouring; but that their large bills, as might be expected, are not fully developed for a considerable period.

The colours of the bill, which are generally very vivid during life, become, in many instances, greatly changed and deteriorated by death: this should be borne in mind by those who describe species from dead specimens, especially if they have been a long time preserved.

Before we proceed to the description of one or two of the species of this most interesting family, it will be necessary to lay before the reader a summary of the anatomy of this form, as it has been demonstrated by Professor Owen, in Mr. Gould's *Monograph*.

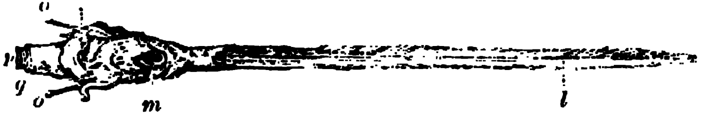
ORGANIZATION.

Digestive Organs.—Professor Owen remarks that the organs of digestion in the toucan present a general simplicity of structure, which accords with its geographical position and power of assimilating both animal and vegetable food, so abundantly provided by nature in a tropical climate. The size of the œsophagus and general width of the intestinal canal correspond to the magnitude of the beak. There is no lateral dilatation of the crop, nor is the gizzard so encroached upon by its muscular parietes as to render such a reservoir for the alimentary substances necessary. The intestinal canal is equally devoid of lateral pouches, or *cæca*; the gastric glands are of a simple form, and are disposed for the extent of an inch around the termination of the œsophagus. The communication of the gizzard with the proventriculus is free, readily permitting regurgitation to take place; and here Professor Owen refers to the record of that act in the papers of Mr. Broderip and Mr. Vigors, adding that as the substances so regurgitated were, after undergoing a second mastication, again swallowed, the act may be compared to the rumination of herbivorous quadrupeds.

In the museum of the Royal College of Surgeons, No. 521 D, prepared by the professor, shows the proventriculus and gizzard of *Ramphastos Ariel*, Vig. It will be seen that the lining membrane at the termination of the œsophagus is thrown into narrow but distinct longitudinal folds; as it passes into the proventriculus it becomes finely reticulate, the orifices of the gastric glands being situate in the interstices of the meshes. These glands are simple cylindrical follicles, forming a complete zone at the end of the gullet, and not separated from that tube by any constriction. The proventriculus communicates with the gizzard by an equally wide aperture. The muscular coat of the gizzard does not exceed half a line in thickness the lateral tendons are small, but very distinct. The lining membrane is of a horny texture, and was stained of a deep yellow colour. The pyloric orifice is remarkably contrasted in its diminutive size with the ample entrance to the gizzard; a structure which facilitates the regurgitation of the alimentary substances. The description then goes on to state that as the regurgitated morsels have been observed to undergo a second mastication, the digestive processes exhibit in this bird the analogy to the ruminants above noticed, and that as the thin parietes of the gizzard of this omnivorous bird are sometimes unequal to the comminution of the food, the utility of the extraordinary developed beak becomes apparent, which thus compensates by additional mastication for the absence of the grinding structure so peculiar to the stomachs of the true vegetable-feeders. (*Cat. Mus. Coll. Chir.*) Professor Owen states that the intestinal canal does not exceed the length of the body including the bill, and that the general structure of the digestive apparatus of the hornbill agrees with that of the toucan. The liver of the latter is composed of two lobes of unequal size, joined by a small band, and the margins of the lobes are more rounded than usual. There is no gall-bladder, and Mr. Owen remarks that in this deficiency the toucan manifests an affinity to the *Picidæ* and *Psittacidæ*, among the *Scansores*; while the hornbill, on the contrary, resembles the *Corvidæ* in the large development of its biliary receptacle. A small hepatic duct enters the duodenum near its commencement; and a second duct, about two lines in diameter, passes to a more distant part of the intestine,' where it terminates close to the insertion of the two pancreatic ducts.

The same anatomist states that the length of the tongue, one of the most remarkable among birds, in a full grown *Rhamphastos Toco* was six inches. The posterior ridge, or backward-projecting process, was broad and finely notched, and situated about four lines from the glottis. Anterior to this process, Mr. Owen describes the tongue as being soft and minutely papillose for the extent of four lines, and here he thinks most probably the sense of taste resides: the rest of the organ consists of a transparent horny lamina, flattened horizontally, and supported by the anterior process of the os hyoides, which forms a ridge along the middle of its inferior surface. At about four inches from the extremity of the horny lamina the margins become obliquely notched, and these notches, becoming deeper and closer together towards the extremity, occasion the bristled appearance on each side of the tongue: these bristles were applied to the food in the cases of the captive toucans above recorded. The cornua of the os hyoides are 1½ inches in length.

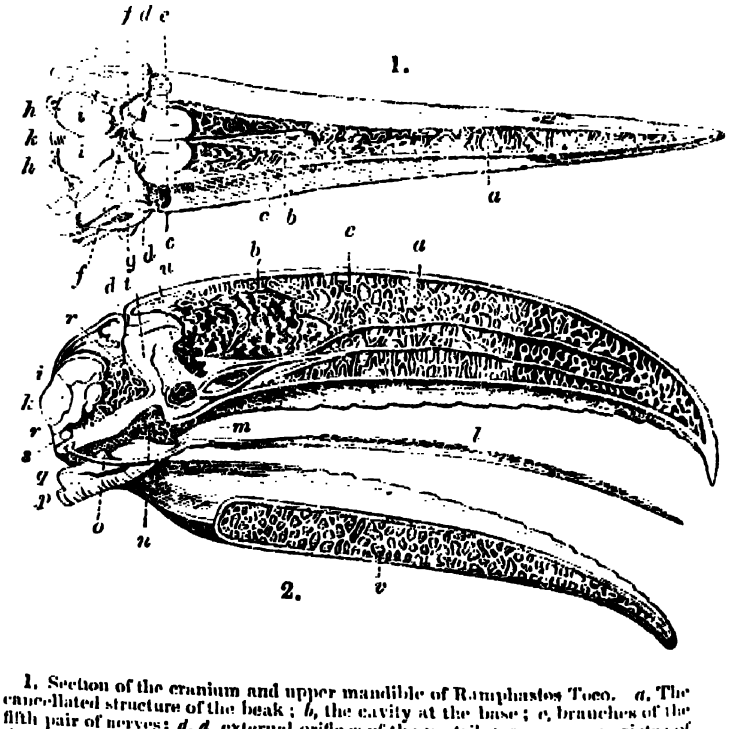
No. 1479 B. (*Mus. Coll. Chir., Physiol. Series*) is the preparation of the tongue of a toucan, showing the flat sheath of horn and the series of short processes directed forwards on each side like the barbs of a feather. The upper larynx, wide fauces, and commencement of the trachea are also here preserved. The base of the tongue is soft, and covered with fine papillæ; it forms posteriorly a denticulated ridge, which is directed backwards, and may serve to protect the laryngeal aperture like an epiglottis. (*Cat. Mus. Coll. Chir.*, vol. iii.)



Upper surface of Tongue of Toucan. (Owen.)

l, The fringed or feathered portion; *m*, orifice of larynx; *n*, orifice of pharynx: *o*, cornua of the os hyoides; *p*, trachea or windpipe; *q*, gullet.

Mr. Owen observes that the osseous portions of the mandibles of the Toucan are disposed in a manner adapted to combine with the great bulk of those parts a due degree of strength and remarkable lightness, and the bony structure is consequently of a most beautiful and delicate kind. 'The external parietes,' continues Mr. Owen, 'are extremely thin, especially in the upper beak: they are elastic and yield in a slight degree to moderate pressure, but present considerable resistance if a force is applied for the purpose of crush



1. Section of the cranium and upper mandible of Ramphastos Toco. *a*, The cancellated structure of the beak; *b*, the cavity at the base; *c*, branches of the fifth pair of nerves; *d*, *d*, external orifices of the nostrils; *e*, osseous parietes of the nasal passages; *f*, osseous tubes protecting the olfactory nerves; *g*, pituitary membrane exposed, and branches of the olfactory nerves radiating from it; *h*, superior semicircular canals of the internal ear; *i*, *i*, hemispheres of the cerebrum; *k*, cerebellum. (Owen.)

2. Vertical longitudinal section of the head. The same letters indicate the same parts as in the previous figure. *l*, The tongue; *m*, glottis; *n*, internal aperture of the nostrils; *o*, os hyoides; *p*, trachea; *q*, œsophagus; *r*, beginning of the spinal chord; *s*, articulating surface of occipital bone; *t*, nasal septum or partition; *u*, air-cell anterior to the orbit, from which the air passes into the mandible; *v*, cancellated structure of the lower jaw. (Owen.)

ing the beak. At the points of the mandibles, the outer walls are nearly a line in thickness; at other parts in the upper beak they are much thinner, varying from 1-30th to 1-50th part of an inch, and in the lower beak are from 1-20th to 1-30th part of an inch in thickness. On making a longitudinal section of the upper mandible, its base is seen to include a conical cavity, about two inches in length and one inch in diameter, with the apex directed forwards. The walls of this cone consist of a most beautiful osseous network, intercepting irregular angular spaces, varying in diameter from half a line to two lines. From the parietes of this cone a network of bony fibres is continued to the outward parietes of the mandible, the fibres which immediately support the latter being almost invariably implanted at right angles to the part in which they are inserted. The whole of the mandible anterior to the cone is occupied with a similar network, the meshes of which are largest in the centre of the beak, in consequence of the union which takes place between different small fibres as they pass from the circumference inwards. It is remarkable that the principle of the cylinder is introduced into this elaborate structure: the smallest of the supporting pillars of the mandibles are seen to be hollow or tubular, when examined with the microscope. The structure is the same in the lower mandible, but the fibres composing the net-work are in general stronger than those of the upper mandible.'

Nervous System and Senses.—Mr. Owen states that the medullary membrane lining these cavities appears to have but a small degree of vascularity. Processes of the membrane, accompanying vessels and nerves, decussate the conical cavity at the base of the beak. The principal nerves are two branches of the fifth pair, which enter at the lower part of the conical cavity, and diverge and ascend as they pass forward to the end of the bill, giving off branches, which are distributed to the horny covering, and supply it with sensibility. 'The air,' says Mr. Owen, 'is admitted to the interior of the upper mandible from a cavity situated anterior to the orbit, which communicates at its posterior part with the air-cell continued into the orbit, and, at its anterior part, with the maxillary cavity. The nasal cavity is closed at every part, except at its external and internal apertures, by the pituitary membrane, and has no communication with the interior of the mandible.'

Smell.—'The organ of smell is confined to the base of the upper jaw. The canal, which is traversed by the air and odorous particles in inspiration, forms a sigmoid curve in the vertical direction. The external orifice is on precisely the same perpendicular line as the internal one. It is situated at the posterior surface of the upper mandible, where it is raised above the level of the cranium; the orifice is consequently directed backwards, secure from all injury that might happen to it in the act of penetrating dense or interwoven foliage. The olfactory canal is at first of almost a cylindrical form, and about two lines in diameter. It passes forwards for about half an inch, receiving from the mesial aspect the projection of the first spongy bone; it then bends downwards and backwards, and is dilated to admit the projections of the two other spongy bones: from this point it descends vertically to the palate, at first contracted, and afterwards dilating to form the internal or posterior orifice. The first or outermost spongy bone is almost horizontal, and has its convexity outwards. The second is nearly vertically placed, with its convexity directed backwards: it terminates in a narrow point below. The third or superior spongy bone makes a small projection towards the mesial plane about the size of a pea. These spongy bones are formed by inward projections of the inner and posterior osseous parietes of the nasal passage; they are cellular, and air is continued into them from the cranial diploë; but the parietes of the nasal passage are entire and smooth, and lined by a delicate pituitary membrane. The inner table of the skull is continuous with the parietes of the nasal cavity, by means of the bony canal which accompanies and protects the olfactory nerves, and which represents, as it were, a single foramen of the cribriform plate of the mammalia. The communication of the cavity of the cranium with that of the nose is thus similarly formed, and is only obstructed in the recent state by the pituitary membrane, on the posterior *cul-de-sac* of which the olfactory nerve distributes its branches in a radiated manner. These branches were confined, as Scarpa has observed in other birds, to the pituitary membrane covering the septum narium and the superior spongy bone.'

Hearing.—'The external orifice of the meatus auditorius is situated about half an inch behind the lower boundary of the orbit. The membrana tympani closes it so obliquely that its plane is directed almost backwards; its anterior edge is consequently about three lines from the external orifice, while its posterior margin is at least six lines from the same point. It is convex outwardly, as in birds generally. The apparatus of the internal ear is easily exposed, the semicircular canals being lodged in a delicate reticulation of the diploë of the cranium. These parts, with the ossiculum of communication and the cochlea, do not present any deviations from the ordinary structure worthy of notice.'

Sight.—The sense of sight in the *Ramphastidæ* appears to be sufficiently well developed, but requires no special observation.

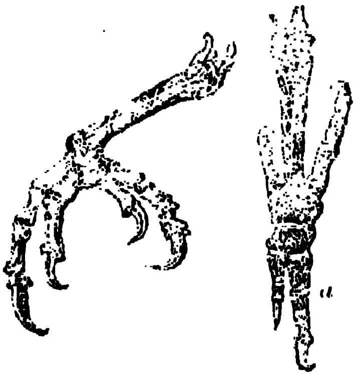
Respiratory and Circulating System.—Mr. Owen found the trachea narrow and simple in its structure, the rings somewhat flattened, and decreasing in diameter towards the inferior extremity, from which a single pair of muscles passes off to the sternum. The length of the lower fourth of the tube, and the state of tension in the bronchia are regulated by a pair of small muscles, which, arising from the sides of the tracheal cartilages, are inserted into the bone of divarication at the extremity of the trachea: this part of the tube is subjected to variations in length, as is indicated by the tortuous character of the recurrent nerves attached to the sides of the trachea in this part. The lungs, small in proportion, are of the usual form and structure, and the abdominal air-cells are also small. The heart is more oblong than it is in birds generally; its apex, as it were, truncate; and its length one inch.

Urinary and Genital System.—The kidneys, composed of three lobes, of which the middle one is smallest, are an inch and a half in length, with a surface convoluted, though in a less marked degree than it is in reptiles. Between the anterior extremities of these glands Mr. Owen found, in a female *Ramphastos Ariel*, the ovary of a triangular shape, and apparently healthy. The ova were like minute granules, and disposed in a convoluted manner. The supra-renal glands were imbedded in the posterior part of the ovary. The oviduct, of the size of a crow-quill, commenced by the usual fimbriated and wide aperture, was slightly tortuous at the commencement, and then continued straight to the cloaca.

Osseous and Muscular Systems.—Certain parts of this system bear upon peculiar functions performed by the Toucans, and are thus described by Professor Owen:—'The pectoral muscles, as in the *Psittacidæ*, are but feebly developed, and the keel of the sternum is of moderate size, not projecting more than half an inch from the plane of the bone. The sternum has four notches at its posterior margin. The clavicles, or lateral halves of the furcula, are here, as in the *Psittacidæ* and *Struthionidæ*, separate; they are an inch in length, slender, pointed at their lower ends, and joined to each other and to the sternum by a ligament only.'

'The peculiar motions of the tail called for a particular examination of that part. It is difficult to state the precise number of the caudal vertebræ, in consequence of the terminal ones being anchylosed, requiring for this purpose the examination of a young specimen at a period before the anchylosis takes place. In the skeleton of a Black-billed Toucan which I have examined, it would appear that three vertebræ are thus anchylosed, making the entire number of coccygeal vertebræ nine. The Woodpecker has also nine caudal vertebræ, and this seems to be the greatest number found in birds. The first six of these vertebræ in the Toucan are articulated by ball-and-socket joints, the ball and the socket being most distinct in the last two joints. That between the sixth and the anchylosed vertebræ is provided with a capsule and synovial fluid; the others have a yielding ligamentous mode of connection. The spinous processes of these vertebræ, both superior and inferior, are of moderate size, but smallest in the sixth, where the greatest degree of motion takes place. The transverse processes, on the contrary, are large and broad, so as almost wholly to prevent lateral motion. The first of the anchylosed vertebræ is broad and flat, and of a rounded form, supporting the two coccygeal glands: the last of these processes is compressed laterally, and of the ordinary ploughshare form. The caudal vertebræ can be inflected dorsad till their superior spines are brought into contact with the sacrum; in the opposite direction they can scarcely be bent beyond a straight line; and it is to this structure of the

bones and joints that is to be attributed the capability in the Toucan of turning its tail upon its back (as represented in the 'Zoological Journal,' vol. ii., pl. xv.*), the muscles presenting comparatively few peculiarities, since the motion alluded to is remarkable rather for its extent than the vigour with which it is performed. The principal elevators of the tail are the sacro-coccygei superiores (sacro-sus-caudiens of Vicq d'Azyr). They arise from two longitudinal ridges on the inferior and convex part of the sacrum, and are inserted into the superior spines of the first six vertebræ by detached tendons terminating broadly in the anchylosed vertebræ. The principal antagonists of these muscles, the sacro-coccygei inferiores (sacro-sous-caudiens of Vicq d'Azyr), pass over the first five vertebræ, and terminate in the sixth and anchylosed vertebræ; their origins are wider apart than in the preceding pair of muscles, coming off from the margin of the sacro-sciatic notches. In the interval are situated small muscles passing from the transverse processes to the inferior spines of the first six vertebræ. From the limited nature of the lateral motions of the tail, the muscles appropriate to these movements are feeble, especially in comparison with those which are observed in the birds that spread their tail-feathers in flight, in order to regulate their course during that vigorous species of locomotion. These muscles are in number two on each side, arising from the posterior extremites of the ischia, and inserted into the expanded anchylosed vertebræ. From the disposition of these muscles it is obvious that after the proper elevators have raised the tail to a certain height, they also become dorsad of the centre of motion, combine their forces with the elevators, and by this addition of power terminate the act of throwing up the tail by a jerk. Mr. Vigors, in his observations on the living animal, observes, that "in these movements the tail seemed to turn as if on a hinge that was operated on by a spring."' (Owen, in Gould's *Ramphastidæ.*)



Foot of Toucan. a, seen from below.

We now proceed to give some examples of the *Toucans* and Araçaris.

Ramphastidæ.

Bill enormous, vascular within; the margins serrated. *Wings* short, rounded. *Feet* with two toes before and two behind. (Sw.)

Ramphastos.

Generic Character.—Bill smooth. *Nostrils* entirely concealed, and placed at the edge of the thickened frontlet of the bill. *Wings* short, rounded; the four outer quills graduated and abruptly pointed. *Tail* short, rounded. (Sw.)

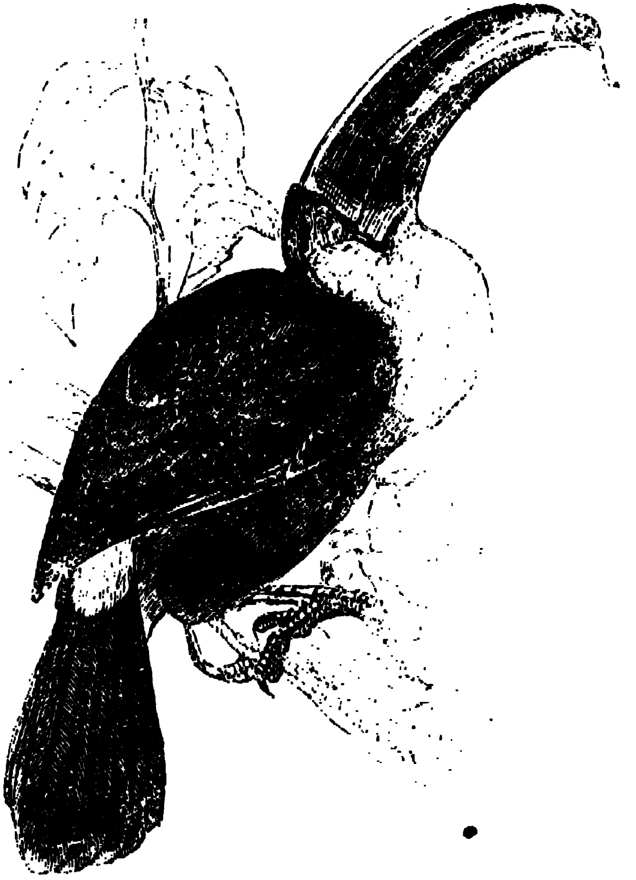
Ramphastos Toco appears to be one of the largest species, being 27 inches in total length. The bill measures 7¼ inches; the wings, 10; the tail, 7; and the tarsi are 2 inches in length. A beautiful figure of the bird, by Lear, is given in Mr. Gould's magnificent work. The range of the species is very wide, perhaps wider than that of any other, being distributed throughout the whole of the wooded districts from the River Plata to Guiana.

We select as an illustrative example, *Ramphastos Cuvieri.*

Description.—Beak brownish black on the sides, with a large basal belt and culminal line of greenish yellow, the basal belt being bounded behind by a narrow line of black, and before by a broader one of deep black, which is only apparent in certain lights; the top of the head and whole of the upper surface black, with the exception of the upper tail-coverts, which are bright orange yellow; cheeks, throat, and chest white, with a tinge of greenish yellow, terminated by a band of scarlet; under surface black; under tail-coverts scarlet. Total length 21 inches; bill 7¼; wings 9; tail 6½; tarsi 2. (Gould.)

Mr. Gould states that this bird is very rare; his own specimen, which he says will be added to the museum of the Zoological Society of London, being the only one which he has ever seen, with the exception of another, of which he has some recollection, in the museum at Berlin. He adds that there is no example in the Paris collection.

Locality.—The densely-wooded districts on both sides of the Amazon.



Ramphastos Cuvieri. (Gould.)

Pteroglossus.

Generic Character.—Bill smooth, less compressed. *Nostrils* vertical, naked, round, pierced on the upper surface of the bill, on the edge of the frontlet. *Wings* short, rounded. *Tail* lengthened, graduated. (Sw.)

Head of Aracari. (Gould.)

The following may be taken as examples of the genus.

Pteroglossus Humboldtii.

Description.—Bill large in proportion to the body; a band of black occupies the culmen from the base to the tip; the remainder of the upper mandible of a dull yellowish orange, with the exception of an indefinite mark of black which springs from each serrature, and a fine line of the same colour surrounding it near the base; lower mandible black, with the exception of the base, which is surrounded with pale yellowish orange; the head, back of the neck, throat, and chest black; all the upper surface, except a spot of scarlet on the rump, of a dull olive; primaries blackish brown; under surface pale straw-yellow with a slight tinge of green; thighs chestnut; naked space round the eyes and tarsi lead colour. Total length about 16 to 17 inches: bill 4, wing 5½, tail 6¾, tarsi 1¾. (Gould.)

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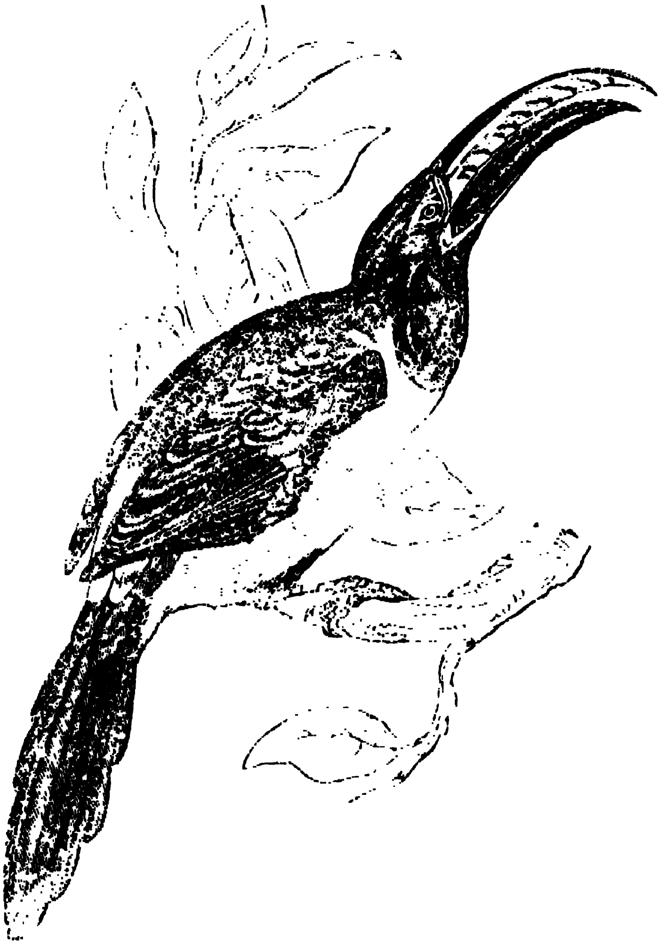
* See page [illegible].

Mr. Gould's elegant figure of a male is taken from a specimen, supposed to be unique, in the Cabinet of Natural History at Munich.

Locality.—Brazils; probably near the Amazon.



Pteroglossus Humboldtii. (Gould.)

Pteroglossus pluricinctus.

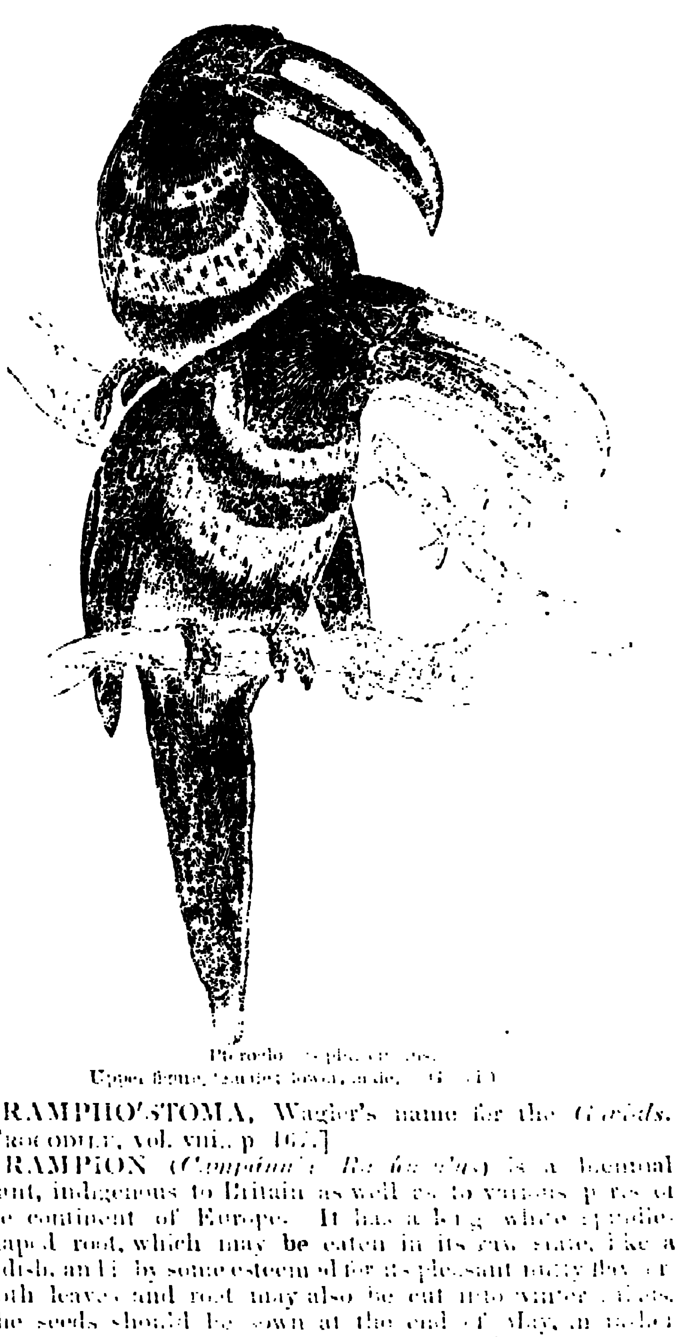
Description.—(*Male.*)—A broad band of black advances from the nostrils along the whole of the culmen, and forms a narrow belt down the sides of the upper mandible at its base; the elevated basal margin of the bill is yellow; the sides of the upper mandible beautiful orange-yellow, fading into yellowish-white towards the tip; under mandible wholly black with a yellow basal ridge; head, neck, and chest black; whole of the upper surface, except the rump, which is scarlet, dark olive-green; breast marked with two broad bands of black, the upper separated from the throat by an intervening space of yellow dashed with red; a similar but broader space separates the two bands of black, the lower of which is bounded by scarlet, advancing as far as the thighs, which are brownish-olive; under the tail-coverts light yellow; naked space round the eyes, tarsi, and feet dark lead-colour.

Female.—Differs from the male in having the ear-coverts brown, and a narrow belt of scarlet bordering the black of the throat.

Total length 20 inches; bill 4½, wings 6½, tail 8¼. (Gould.)

Locality.—Brazil.

The most characteristic figures of the *Ramphastidæ* known to us are those by Mr. Swainson, in his 'Zoological Illustrations,' and the highly finished plates in Mr. Gould's *Monograph*; the latter, from their size, beauty, and accuracy, have all the air of portraits.



Pteroglossus pluricinctus.
Upper figure, male; lower, female. (Gould.)

RAMPHO'STOMA, Wagler's name for the *Gavials*. [CROCODILE, vol. viii., p. 167.]

RAMPION (*Campanula Rapunculus*) is a biennial plant, indigenous to Britain as well as to various parts of the continent of Europe. It has a long white spindle-shaped root, which may be eaten in its raw state, like a radish, and is by some esteemed for its pleasant nutty flavour. Both leaves and root may also be cut into winter salads. The seeds should be sown at the end of May, in rather light soil, and thinly covered. The roots will be fit for use throughout the following winter.

A different plant, the *Œnothera biennis*, is sometimes called German Rampion (*Rapunzel Sellery*). Its roots are used like those of the above, and the plants are cultivated in the same manner as carrots or parsnips.

RAMPOOR. [HINDUSTAN, p. 219.]

RAMSAY, ALLAN, was born in 1685, of parents of the humblest class, at a small hamlet, or settlement of a few cottages, stated to be now in ruins, on the banks of the Glangonar, a tributary of the Clyde, among the hills that divide Clydesdale and Annandale. The parish was probably that of Crawford in Lanarkshire, through which the Glangonar flows, and where are situated Lord Hopetoun's lead-mines, in which Ramsay's father is said to have been a working man, and he himself to have been employed when a child as a washer of ore. When he made his first appearance in Edinburgh, about the beginning of the last century, Allan was apprenticed to a barber; and he appears to have followed that trade for some years. In course of time however he exchanged it for that of a bookseller, led probably by a taste for reading which he had acquired. He seems to have early in life enjoyed considerable popularity as a boon companion, and we may presume that it was in this character that he first gave proof of his poetic talents. He gradually however obtained the acquaintance of many of the most distinguished persons both in the literary and fashionable circles of the Scottish capital; and in 1721 he published a volume of his poems, which was very favourably received by his countrymen. In 1724 he published, in two small volumes, 'The Evergreen, being a Collection of Scots Poems, wrote by the ingenious before 1600.' The materials of this collection (which has been lately reprinted) were chiefly obtained from the volume called the Bannatyne MS., preserved in the Advocates' Library; but Ramsay, who had little scholarship, and who lived in a very uncritical age as to such matters, has paid no attention to fidelity in making his transcripts, patching and renovating the old verses throughout to suit his own fancy. 'The Evergreen' was followed the same year by 'The Tea-Table Miscellany, or a Collection of Choice Songs, Scots and English,' in four volumes, which has been often reprinted. The edition before us, dated 1763 (London), is designated the twelfth. This collection, besides many new verses contributed by Ramsay himself and some of his friends, contains numerous old Scottish songs, which, he observes in his preface, 'have been done time out of mind, and only wanted to be cleared from the dross of blundering transcribers and printers.' His scouring however went the length in many cases of rubbing away the old song altogether; and his substitutions are by no means always a compensation for what he thus destroyed, though most of them are clever and spirited, and have acquired general currency among Scottish song-singers. No older copies, it ought to be stated, either printed or manuscript, are now known to exist of many of the songs professing to be antient preserved in this collection; and there can be little doubt that Ramsay was indebted for many of them merely to oral tradition. Ramsay afterwards wrote many more verses in his native dialect; but his only two original performances of any considerable pretension are his comic pastoral, the 'Gentle Shepherd,' published in 1729, and his continuation of the old Scottish poem of 'Christ's Kirk on the Green,' attributed by some to James I.; by others, with more probability, to James V. There is a good deal of rather effective though coarse merriment in the latter attempt. The 'Gentle Shepherd' is, as a whole, not very like anything else that Ramsay has written; but there seems to be no evidence for the notion which has been suggested, that in this instance he fathered the production of some other writer. The name of this supposed other writer, we believe, has never been so much as suggested or attempted to be guessed at; nor were any of the circumstances attending the publication suspicious or mysterious. The poem too, although more careful and elaborate than anything else that Ramsay has left us, is not without the wonted qualities of his manner, both good and bad. It has no more elevation or refinement than any of Ramsay's other works, though less that is offensively coarse or boisterous than some of them; both in the diction and the thought it flows easily and smoothly; and though there are not many happy touches, and no daring strokes, there is a general truth of painting about it in a quiet tone, which is very soothing and agreeable. It has also some humour, which however is rather elaborate and constrained.

Ramsay died in 1758, leaving a son of the same name, who acquired considerable distinction as a portrait-painter.

(See Currie's *Life of Burns*; and, for a very severe, indeed an outrageous critique of the 'Gentle Shepherd,' Pinkerton's *List of the Scottish Poets*, prefixed to his *Antient Scottish Poems*, 1786, vol. i., pp. 132, &c.)

RAMSDEN, JESSE, was born at Salterhebble, near Halifax, Yorkshire, in 1735. He was the son of an innkeeper. When nine years old he was admitted into the free grammar-school of Halifax; and after attending there for about three years, he was placed under the protection of an uncle, who resided in the north of Yorkshire. By him he was sent to a school conducted by Mr. Hall, a clergyman, who was in repute as a teacher of the mathematics, and under whom he attained to some proficiency in geometry and algebra. His studies were interrupted by his father apprenticing him to a cloth-worker at Halifax. At the age of twenty we find him engaged as a clerk in a cloth warehouse in London, in which capacity he continued till 1757-8, when his predilection for other pursuits led him to bind himself for four years to a working mathematical and philosophical instrument maker, named Barton, in Denmark Court, Strand. Upon the completion of his term, he engaged himself as assistant to a workman named Cole, at a salary of twelve shillings a week; but this connection was of short duration. He then commenced working on his own account, and his skill as an engraver and divider gradually recommended him to the employ of the leading instrument-makers, more particularly Nairne, Sisson, Adams, and Dollond. Ramsden subsequently married Dollond's daughter, and he received with her a part of Mr. Dollond's patent right in achromatic telescopes. His occupation afforded him frequent opportunities of observing the defective construction of the sextants then in use, the indications of which, as had been pointed out by Lalande, could not be relied on within five minutes of a degree, and might therefore leave a doubt in the determination of the longitude amounting to fifty nautical leagues. The improvements introduced by Ramsden are said by Piazzi to have reduced the limits of error to thirty seconds. This circumstance, added to the cheapness of his instruments, which were sold for about two-thirds the price charged by other makers, soon produced a demand which, even with the assistance of numerous hands, he found difficulty in supplying. In his workshops the principle of the division of labour was carried out to a considerable extent, and a proportionate dexterity was acquired by the workmen; but it is asserted that in none of these, even the most subordinate, and least of all in the higher departments, did the skill of the workmen surpass that of Ramsden himself. His attention was incessantly directed to new improvements and further simplification, the result of which was the invention of a dividing-machine, which has been already noticed under GRADUATION. The date of this invention is prior to the year 1766. At first it had many imperfections; but by repeated efforts of ingenuity throughout a period of ten years, they were successfully removed. In 1777 it was brought under the notice of the Commissioners of the Board of Longitude, by Dr. Shepherd, and by them a premium of 615*l.* was paid to the author, upon his engaging to divide 'sextants at six, and octants at three shillings, for other mathematical instrument makers. A description of the machine was immediately published, by order of the Board, under the supervision of Dr. Maskelyne (London, 1777, 4to.), and was shortly after translated into French by Lalande. A duplicate of the machine itself is said to have been purchased by the president, Bochard de Saron, and introduced into France concealed in the support of a table made for that purpose. (Weiss, *Biog. Univers.*) As early as 1788 no less than 983 sextants and octants had issued from Ramsden's workshop. In 1779 the description of another machine constructed by Ramsden for dividing straight lines by means of a screw was also published by order of the Board; but this invention does not appear to have been of much practical use. It was however in the construction of many of the larger class of astronomical instruments that Ramsden acquired most reputation, though they were probably least productive of pecuniary gain. The theodolite employed by General Roy in the English Survey was made by Ramsden, and no instrument of the kind that had been previously made would bear comparison with it. A similar remark is applicable to the equatorial constructed for Sir George Schuckburgh, which was also the largest that had then been attempted. Ramsden took out a patent for his new equatorial, and a description of it was published by the Hon. Stewart Mackenzie, brother to the earl of Bute; but his inventive genius seldom permitted him to construct two instruments alike. His telescopes, erected at the observatories of Blenheim, Mannheim, Dublin, Paris, and Gotha, were remarkable for the superiority of their object-glasses; and in his mural quadrants, furnished to the observatories of Padua and Vilna, Dr. Maskelyne was unable to detect an error amounting to two seconds and a half, a degree of accuracy which was then a matter of admiration among astronomers. Ramsden however always recommended that the mural quadrant should be superseded by the mural circle; and the circles erected in the observatories of Palermo and Dublin, the first of which was of five and the latter of twelve feet diameter, were constructed by him in accordance with this recommendation.

Among Ramsden's minor inventions and improvements may be enumerated his catoptric and dioptric micrometers (described in the 'Phil. Trans.,' 1779), the former of which was an improvement upon that of Bougier; optigraph; dynamometer (for measuring the magnifying powers of telescopes); barometer; electrical machine; manometer; assay-balance; level; pyrometer; and the method introduced by him for correcting the aberrations of sphericity and refrangibility in compound eye-glasses. (*Phil. Trans.*, 1783.)

Ramsden was elected a fellow of the Royal Society in 1786. In 1794 a similar compliment was paid him by the Imperial Academy of St. Petersburg; and the following year the Copley medal was awarded to him by the Royal Society, in testimony of the importance of his various inventions. By this time his health had become much impaired by his ardent devotion to his profession. In 1800 he was advised to visit Brighton, where he died, on the 5th of November of that year. From 1766 to 1774 his shop and residence was in the Haymarket; but in the latter year he removed to Piccadilly, where his business continued to be conducted after his decease.

In his habits we are told that he was temperate to abstemiousness, and that for many years he restricted himself to very few hours of repose. Most of the time that he could spare from the immediate duties of his profession was devoted to the perusal of works of science and literature. His memory was remarkably retentive, and at an advanced age he made himself sufficiently master of the French language to read Molière and Boileau. The fortune of which he died possessed was not considerable, and a large portion of it was directed by his will to be distributed among his workmen.

See CIRCLE; EQUATORIAL; GRADUATION; TRANSIT-INSTRUMENT; SEXTANT; &c.; and Pearson's *Practical Astronomy*, Lond., 1829, vol. ii., pp. 12, 18, 47, 181-5, 194-6, 285-6, 413-28, 519, 533-46, 558 60, and 573.

(Piazzi's *Account of the Life and Labours of Ramsden*, in a letter addressed by him to Lalande, and published by the latter in the 'Journal des Sçavans' for Nov., 1788, p. 744. This interesting letter was written by Piazzi while urging the progress of his mural circle, the construction of which had been undertaken by Ramsden, but the advance of which towards completion does not appear to have kept pace with Piazzi's wishes; and though it doubtless contains no unmerited eulogium, it seems to have been intended by Piazzi to act as a stimulant. *Philosophical Magazine*, vol. xvi.; *European Magazine*, February, 1789; *Biog. Univers.*; and the *Communication of the Rev. L. Dutens to Dr. Aikin*, in *General Biography*, art. 'Ramsden.')

RAMSEY. [MAN, ISLE OF.]

RAMSGATE, a town in the Isle of Thanet in Kent, 71 miles from London-bridge, through Dartford, Rochester, and Canterbury. The ville of Ramsgate, comprehending 260 acres, was included formerly in the parish of St. Lawrence, in the hundred of Ringslow or Thanet, in the lathe of St. Augustine; but provided separately for its own poor: in 1827 it was made a distinct parish. The ville is a member of the Cinque-Port of Sandwich. Ramsgate was antiently a poor fishing-town, consisting of a few meanly-built houses, built on the coast of the Isle of Thanet, which here fronts the south-east: it had a small wooden pier. After the Revolution of 1688, some of the inhabitants engaged in the Russian trade, by which they acquired wealth, and this led to the improvement of the town. When the practice of families from London and elsewhere resorting to the sea-side became general, Ramsgate was one of the earliest frequented spots, though for some time eclipsed by the superior attractions of Margate. The improvement of the harbour by the erection of the piers and other works in the middle and latter part of the last century, gave another impulse to the prosperity of the town. Early in the present century a stone lighthouse was erected on the head of the west pier; a small battery is fixed at the head of the east pier. The east pier is one of the longest in the kingdom, extending 2000 feet; the western pier extends about half that length: they are built of Portland and Purbeck stone and Cornish granite. The harbour includes an area of 48 acres, and furnishes a convenient shelter for vessels which are obliged by heavy gales to run from the Downs. It is provided with a basin and floodgates in the upper part of the harbour for scouring it from the drifted sand or mud.

The old part of Ramsgate is situated in one of those natural depressions (called in the Isle of Thanet 'gates,' or 'stairs') in the chalk, which open upon the sea. This part of the town is low compared with the higher parts on each side of it. The streets in the old part of the town are narrow and indifferently built. The newer part of the town, from its elevated site on the cliffs, commands an extensive sea-view, and consists of several streets macadamized and lighted with gas. Many of the houses are very handsome: some are arranged in streets, terraces, or crescents, while others are detached villas. At present (1840) a considerable number of houses are building. There are bathing-rooms, assembly-rooms, boarding and lodging houses, a handsome new church, a chapel-of-ease, and several dissenting meeting-houses.

The population of the ville of Ramsgate, including the town, was, in 1831, 7985. There is considerable coasting trade; coal is imported in considerable quantity; and ship building and rope-making are carried on. It is observable as indicating the commercial character of the place, tha though the population of Margate exceeds that of Ramsgate by 2300 or 2400, there are not half as many persons engaged in retail trade or handicraft as at the latter place. The markets are on Wednesday and Saturday. A considerable fishery is carried on; in the summer steam-boats sail regularly between London and Ramsgate.

The living of Ramsgate is a vicarage, of the clear yearly value of 400*l.*, in the gift of the vicar of St. Lawrence, the mother church.

There were, in 1833, two infant schools, with 217 children of both sexes; a national day and Sunday school with 150 boys and 100 girls; twenty day-schools, estimated to contain about 525 children; six boarding-schools, supposed to contain 170 children; and three Sunday-schools, two of them containing 300 children; from the other no return was made.

RAMSON (*Allium ursinum*), a species of garlic found wild in many parts of Britain, and formerly cultivated in gardens; but its use is superseded by the *Allium sativum*, a native of Sicily, which is the *Garlic* now in cultivation.

RAMTILLA, a genus of plants of the natural family of Compositæ, and subtribe Heliantheæ, so called from the Indian name *ram-tilla*, by which the oil of its seed is designated. The plant is remarkable for the number of names by which it has been described by botanists. Of these we need only mention the *Verbesina sativa* of Roxburgh, and the *Ramtilla oleifera* of De Candolle. Cassini had however previously formed it into a new genus, and under the name of Guizotia 'dedicated it to the celebrated historian, then minister of public instruction.' This name, being prior to that of Ramtilla by a year or two, is now retained as that of the genus. De Candolle, having obtained specimens and seeds from various countries, discovered that the Indian plant was identical with one from Abyssinia, which has been mentioned by Bruce under the name of Polymnia frondosa. The fact is interesting in a plant cultivated in both countries for the same purposes, and forming one of the links which indicate the connection which existed in early times between India and Upper Egypt. This plant is cultivated in different parts of India, from October to March, in fields, for the sake of the seed, from which an oil is expressed, and used as a subsitute for that of the Sesamum, which is considered the best kind. It is used both in dressing food and as a lamp oil.

RAMUS, PETER (PIERRE DE LA RAME'E), was born in a village in Picardy, in the year 1502, according to one account, and in the year 1515 according to another. His parents were extremely poor, and the future philosopher was set when a boy to tend sheep. Disgusted with this employment, and having an ardent desire to get knowledge, he ran away from his parents to Paris. After some time, and after he had encountered much misery, one of his uncles offered some pecuniary assistance, and Ramus now entered the College of Navarre as a servant. He made great progress in all studies, with very little assistance from masters. At the completion of his course, when he presented himself for the degree of master of arts, he undertook as an exercise what then seemed the almost impious task of showing that Aristotle was not infallible. This was the beginning of the anti-Aristotelian opinions by which Ramus afterwards gained his notoriety and fame. The exercise was adjudged successful, and Ramus henceforth devoted himself to the study of the works of Aristotle as to the object of his life. In 1543 he published his new system of logic, with strictures on the logic of Aristotle. The publication of this work exposed him to great obloquy. He was charged with impiety and sedition, and with a desire to overthrow all science and religion, through the medium of an attack on Aristotle. On the report of an irregular and partial tribunal, appointed to consider the charges made against him, the king ordered his works to be suppressed, and forbade his teaching or writing against Aristotle on pain of corporal punishment. Ramus availed himself of the leisure which the compulsory cessation of his lectures procured for him, to study mathematics and prepare an edition of Euclid. Shortly afterwards he began a course of lectures on rhetoric at the College of Presles, the plague having driven away numbers of students from Paris. He was named Principal of this college, and the Sorbonne ineffectually endeavoured to eject him on the ground of the royal prohibitory decree. This decree wa cancelled in 1545, through the influence of the Cardinal de Lorraine, to whom he had dedicated his edition of Euclid. He now began a course of mathematics in Paris. In 1551, he was named by the king (Henri II.) professor of philosophy and eloquence in the College of France. During the next ten years, he published a Greek, Latin, and French grammar, and several treatises on mathematics, logic, and rhetoric. Ramus had embraced Protestantism, and now shortly again brought upon himself great trouble by the zeal with which he advocated the new doctrines. Charles IX. offered him an asylum at Fontainebleau; but while he was absent from home, his house was pillaged and his library destroyed. He returned to Paris in 1563, and resumed possession of his royal chair. Civil troubles again drove him away from Paris, and in 1568 he asked permission to travel. He went to Germany, and was received everywhere with honour. He gave lectures on mathematics at Heidelberg, and while in this town he made public profession of Protestantism. Shortly after his return to Paris, he fell a victim in the massacre of St. Bartholomew.

Although Ramus had many merits as a philosopher, and did much good by his opposition to the Aristotelian philosophy, which then held men's minds in bondage, he was wanting in depth and caution, and his strictures on Aristotle are by no means altogether just. He had many followers. The influence of Melanchthon, on the other side, did not prevent the progress of his system of logic in the German universities. France, England, and particularly Scotland, were full of Ramists. Andrew Melville introduced the logic of Ramus at Glasgow.

The following is a list of the principal works of Ramus: 1, 'Institutiones Dialecticæ Tribus Libris distinctæ;' 2, 'Animadversiones in Dialecticam Aristotelis;' 3, 'Rhetoricæ Distinctiones in Quintilianum;' 4, 'Arithmeticæ Libri Tres;' 5, 'In Quatuor Libros Georgicorum et in Bucolica Virgilii Prælectiones;' 6, 'Ciceronianus.' (A life of Cicero, interspersed with many philological remarks on the Latin language, and strictures on the state of education in France.) 7, 'Scholæ Grammaticæ Libri Duo;' 8, 'Grammatica Latina;' 9, 'Grammatica Græca quatenus à Latina differt;' 10, 'Gramère Fransoeze;' 11, 'Liber de Moribus Veterum Gallorum;' 12, 'Liber de Militia Julii Cæsaris;' 13, 'Commentarius de Religione Christiana, Libri Quatuor;' 14, 'Præfationes, Epistolæ, Orationes' (Paris, 1599, and Marburg, 1599) The Greek Grammar of Ramus received considerable additions from Sylburgius.

The above list is taken from the article 'Ramus,' in the *Biographie Universelle*. For a complete list of the works of Ramus the reader is referred to Niceron (*Mém.*, tom. xiii.).

RAMUSIO, GIAMBATTISTA, was born at Treviso in the Venetian State, in 1485, of a family originally from Rimini, which produced several men of learning. He filled several offices under the republic, and became secretary to the Council of Ten. Having undertaken a collection of the most important narratives of voyages and travels performed in distant counties both in antient and modern times, he translated into Italian those that had been written in other languages, and added his own remarks and several dissertations, which show that he possessed very extensive general information for the age in which he lived. He was a friend of Bembo, Fracastoro, and other learned contemporaries. His work is entitled 'Raccolta di Navigazioni e Viaggi,' 3 vols. fol. The first volume was printed by Giunti at Venice, in 1550; another volume appeared in 1556, and a third in 1559, after Ramusio's death, which took place at Padua, in July, 1557. Subsequent editions appeared with the addition of several travels which had not appeared in the first. The most complete edition is that of 1606. The following list of contents will convey an idea of the value of the work:—Vol. i., 'Leo Africanus's Description of Africa; Cadamosto a Venetian navigator, preceded by a Discourse by Ramusio; Sintra, a Portuguese narrative; Hanno's Periplus; Navigation from Lisbon to St. Thomé, by a Portuguese pilot; Ramusio, a Discourse on the Navigation of the Portuguese to the East Indies; Voyage of Vasco de Gama in 1497, written by a Florentine; Pedro Cabral Alvarez, voyage from Lisbon to Calicut in 1500, written by a Portuguese pilot; Amerigo Vespucci, two letters to Pietro Soderini; a Summary of Vespucci's Voyages; Thomas Lopez, a Portuguese, Voyage to the East Indies; Giovanni da Empoli, a Florentine, Journey to India: Ludovico Barthema of Bologna, Itinerary, preceded by a Discourse by Ramusio; Iambolus, Voyage extracted from Diodorus, with a Discourse by Ramusio; Andrea Corsali, a Florentine, Two Letters to Julian and Lorenzo de' Medici; Alvarez, Travels to Ethiopia, with the submission of Prester John to Pope Clement VII.; Ramusio, Discourse on the Rise of the Nile, with a reply by Fracastoro; the Voyage of Nearchus translated from Arrian's text; Journey of a Venetian from Alexandria to Diu in India in 1538; Arrian's Navigation from the Red Sea to India; Barbosa, a book of travels to the East Indies; a brief account of Kingdoms and Towns between the Red Sea and China, translated from the Portuguese; Antonio Conti, a Venetian, Journey to India, written by Poggio Bracciolini; Jeronimo da San Stefano, a Genoese, his letter written from Tripoli in 1499; Ramusio, Discourse on the Voyage round the World by the Spaniards; Maximilian of Transylvania, Epistle concerning the Navigation of the Spaniards; a short account of the Voyage of Magalhaens; Pigafetta, Voyage round the World; the Navigation of a Portuguese who accompanied Edward Barbosa in 1519; Ramusio, a Discourse concerning the Voyages to the Spice Countries; Juan Gaetan, a Castilian pilot, Discovery of the Moluccas; Information concerning Japan, by the Portuguese Jesuits; João de Barros, Chapters extracted from his History.'

Vol. ii. contains 'Marco Polo's Travels, with a preface by Ramusio; Hayton, an Armenian, Discourse on the origin of the Great Khan and the condition of the Tartars; Angiolelli, Life and Actions of Hussan Cassan; the Travels of a Merchant into Persia in the years 1517-20; Giosafat Barbaro, a Venetian, Journey to the Tana (the river Tanais) and into Persia; Ambrosio Contarini, Journey into Persia; Alberto Campense, Letters to Clement VII. concerning the affairs of Muscovy; Paul Giovio, Reports on the affairs of Muscovy, by him collected; Herbestein, Commentaries on Muscovy and Russia; Arrian's Letter to Hadrian concerning the Euxine; Interiano, a Genoese, on the habits and manners of the Zythi, called Circassians; Hippocrates, extract of his Treatise on Air and Water, in which he speaks of the Scythians; Piero Quirino, a Venetian, Account of his Voyage and Shipwreck; Sebastian Cabota, Navigation in the Northern Seas; Caterino Zeno, a Venetian, Travels to Persia; Niccolo and Antonio Zeno on the Discovery of Iceland; Travels into Tartary by some Dominican monks; Olderico da Udine, Two Journeys into Tartary; Guagnini, a Venetian, Description of European Sarmatia; Matthew Micheow of Cracow, Description of the two Sarmatias.'

Vol. iii.:—'Pietro Martire of Angleria, extract from his History of the New World; Oviedo, extract from his History of the West Indies; Hernan Cortez, Narrative of his Conquest of Mexico; Pedro de Alvarado, two letters to Hernan Cortez; Diego Godoy, a letter from New Spain; Narrative of one of Cortez's companions concerning Mexico, with two maps, one of the Great Temple, and another of the Lake; Alvaro Nuñez, Narrative of the Indies and of New Galicia in 1527-36; Guzman on the Conquest of New Spain; Francisco Ulloa, Voyage in the Mar Vermejo, or Sea of California; Vasquez de Coronado, Narrative of a Journey to Cevole, or the Kingdom of the Seven Cities; Alarcon, Voyage to discover the Kingdom of the Seven Cities in 1540; Ramusio, Discourse on the Conquest of Peru: Narrative of a Spanish Captain concerning the Conquest of Peru; Francisco Xeres, Narrative of the Conquest of Peru and New Castile; Narrative of a Secretary of Francisco Pizarro concerning the Conquest of Peru; Gonzalo de Oviedo, Navigation of the river Marañon; Ramusio, Discourse concerning New France; Giovanni da Verazzano, a Florentine, Narrative written from Dieppe, in July, 1524; Discourse of a great Naval Captain concerning the Navigation of the West Indies; Jacques Cartier, First and Second Narrative of Voyages to New France; Cesare de Federici, Voyage to the East Indies and beyond India; Three Voyages of Hollanders and Zealanders to China, New Zembla, and Greenland.'

Among the above series are several curious narratives which are not found in any other collection. Ramusio left materials for a fourth volume, which unfortunately were destroyed in a fire which broke out in the printing-press of Giunti, in November, 1557.

(Camus, *Mémoires sur les Collections de Voyages*: Gamba, *Serie dei Testi di Lingua*.)

RANDAZZO. [Messina.]

RANDERS is a thriving Danish trading town, in the diocese of Aarhuus, in the province of Jutland. It is situated in 56° 28′ N. lat. and 10° 3′ E. long., near the

Baltic, on the river Guden, which is here navigable. It is a walled town with seven gates, and next to Aarhuus, is the most considerable place in Jutland, having a population of 5600 inhabitants. There is one church, a large hospital, a grammar-school, and an Agricultural Society. The inhabitants manufacture gloves, stockings, woollen cloth, earthenware, and lampblack; calico-printing, brewing, and brandy-distilling are carried on to a considerable extent. There are some vinegar manufactories and one sugar-house. This place has a very brisk trade, especially in corn.

RANDOLPH, THOMAS, an English poet, was born in the year 1605, at Badby in Northamptonshire. He was the second son of William Randolph of Little Houghton, steward to Edward lord Zouche, by his first wife Elizabeth, daughter of Thomas Smith of Newnham in the same county.

He was educated at Westminster school, and thence elected scholar of Trinity College, Cambridge, in the year 1623. He was afterwards made fellow on the same foundation, and admitted to an ad eundem degree at Oxford in 1631. After some stay at Cambridge, he came to London, where he was much noticed by Ben Jonson, who called him his adopted son. He became intimate also with many of the other wits of that day. The promise of his youth was marred by a career of dissipation and extravagance, which shortened his life prematurely. He died while on a visit to a friend at Blatherwick in Northamptonshire, where he was buried, March 17, 1634-5, and his memory honoured by a monument erected at the charge of Sir Christopher (afterwards lord) Hatton of Kirby.

Randolph's 'Poems, Translations, and Plays,' were published in London, 1634, 4to.; and his 'Poems, with the Muses' Looking-Glass and Amyntas,' at Oxford, in 1638, 4to. There have been several other editions published since, both in London and at Oxford. His plays are—'Aristippus,' and 'The Conceited Pedlar,' published together in 1630, 4to.; 'Jealous Lovers,' 1632, 4to.; 'The Muses' Looking-Glass,' Lond., 1638, 4to.; 'Amyntas,' Oxford, 1638, 4to.; 'Hey for Honesty, Down with Knavery,' a comedy. 'The Prodigal Scholar,' a comedy, and 'The Dolium Cornelianum,' a Latin play in the style of Plautus, have been attributed to him.

Randolph's writings are the production of a mind well imbued with classical literature, and he has in many passages not unskilfully interwoven the language and imagery of the best authors of antiquity. He wrote Latin verse with ease and fluency, and translated from Claudian with considerable elegance. But his English compositions are not free from the faults imputed to most of his contemporaries, and are often disfigured by licentiousness, obscurity, and strained conceits, exhibiting more learning and ingenuity than good taste. They consist of addresses to different friends, epigrams, translations, and amatory pieces. His dramas present very few attractions to the modern reader. The characters are either mere impersonations of virtues and vices, or feeble and pedantic travesties from Greek and Roman comedy. The plots are perplexed and devoid of interest, and the dialogue seldom rises above mediocrity, though occasionally relieved by passages showing much original power of description. The most popular of his plays is the 'Muses' Looking-glass,' which was re-acted in the last century. For further particulars of his life see Jacob's *Poetical Register* (which contains a curious anecdote of his first interview with Ben Jonson); Wood's *Athenæ Oxonienses*; Baker's *Hist. of Northamptonshire*. His works are reviewed in the *Retrospective Review*, vol. vi.; and a list of them is given in Watt's *Bibliotheca Britannica*.

RANELLA. (Malacology.) [SIPHONOSTOMATA.]

RANGE. [GUNNERY; PROJECTILES.]

RANGER (*Rangeator*), an antient officer in the king's forests and parks, appointed by patent, and enjoying certain fees, perquisites, and other advantages. His duty was of three kinds: 1, to make daily perambulations, to see, hear, and inquire concerning any wrong doings in the limits of his bailiwick; 2, to recover any of the beasts which had strayed beyond the limits of the forest or chase; and, 3, to present all transgressions at the next forest-court.

RANGOON is the most commercial port of the Birman Empire. It is near 16° 40′ N. lat. and 96° 18′ E. long., and is built on the most eastern branch of the river Irawadi, about twenty-six miles from the sea. About two miles below the town, the river divides into two arms, of which the eastern, running nearly due east, is called Syrian River; and the western, running nearly due south, Rangoon River. Both of these branches are navigable, but the Rangoon River is generally preferred. Though the navigation is somewhat intricate, the difficulties are easily overcome by the assistance of tolerable pilots. Vessels of 1200 tons burden have proceeded to the town. This eastern branch is the only one of the Irawadi which is navigable for large vessels, except that of Bassein, which has the disadvantage of being nearly dry above the town of Bassein during the dry season, whilst the eastern branch may always be navigated by large river-boats; consequently Rangoon has the advantage of an uninterrupted communication with the upper provinces at all seasons.

The town is on the left bank of the river, at a place where it runs nearly due east and west. From the banks of the river the ground continues to rise gradually for more than two miles to the foot of the hill on which the grand Dagong Pagoda is built, the bottom of which appears to be 70 or 80 feet above the level of the Irawadi. The town and suburbs extend about a mile along the bank of the river, but the houses are very unequally scattered over this area. The streets are narrow, but clean and well paved. The houses are raised on posts, the smaller supported by bamboos and the larger by strong timbers. There are a few brick houses, chiefly belonging to Europeans, who pay a heavy tax for this privilege: no subject of the Burmese emperor is permitted to erect a brick building. These brick houses are built within the myo, or city, which is an irregular quadrangle, surrounded by a stockade 14 feet high, and composed of heavy beams of teak timber. The north and south faces of this stockade are 1145 yards long; the east 598, and the west 197 yards. It has in some places a stage to fire musketry from, through embrasures or loopholes. On the south side of the stockade towards the river is a ditch, over which there is a causeway. The ditch is about 20 or 30 yards from the banks of the river. In the interior of the stockade are three wide and clean streets running east and west, and three smaller ones crossing them and fronting the gates on the south face.

Two narrow roads, paved with brick, lead from the southern face of the stockade to the great pagoda, Shewi Dagong, and along the sides are built a number of *sidis*, or monuments in honour of Buddha. In form they may be compared to a speaking-trumpet standing on its base. The lower part is generally a polygon, and the shaft or upper part is round, the apex being ornamented with an iron net in form of an umbrella, called a *ti*. The Shewi Dagong is in the same style as the rest, but richly gilt all over. It is said to be about 278 feet high, and is surrounded by an enclosure, in which is an immense bell of very rude fabric. This pagoda is a place of pilgrimage, frequented by many strangers, especially Shans, who live in the country east of the river Saluen.

Rangoon is very convenient for ship-building, as the tide rises from 18 to 24 feet, and the great teak-forests are near it. The timber may be floated down the whole way from the forests near Sarwa to Rangoon. According to Crawfurd, not less than 111 square-rigged vessels of European construction were built there from 1786 to 1824. Some of them were from 800 to 1000 tons burthen.

Rangoon was built by Alompra, after the destruction of Pegu and Syrian in 1755, and the choice of the site shows the sagacity of the conqueror. Besides its advantageous situation for commerce, the elevated ground on which it is built secures it from being inundated by the tropical rains, to which all the low lands of the delta of the Irawadi are subject. The climate is temperate, agreeable, and salubrious. The place at first rose slowly. Even at the beginning of the present century the number of vessels that cleared out was only from 18 to 25 annually. But between 1811 and 1817 the number increased to 35 and 36. From 1817 to 1822 the average was 40 ships, and in the last-mentioned year 56. Since the time of its occupation by the British (from 1824 to 1826) its commerce with Calcutta and other British possessions in India has been continually increasing. The most active commerce is carried on with Chittagong, Dacca, Calcutta, Madras, Masulipatam, the Nicobar Islands, and Pulo Penang; there is also some trade with Bombay and the Persian and Arabian gulfs. The articles exported are teak-wood, catechu, stick-lac, bees'-wax, elephants' teeth, raw cotton, orpiment, gold, silver, rubies, and horses. The most important of these articles is teak-timber, and Calcutta is the principal mart for it. Raw cotton of superior quality goes in great quantity to Dacca, where it is used in the fabrication of the finest muslins. The principal imports are cotton piece-goods, from Britain, Bengal, and Madras, British woollens, iron, steel, quicksilver, copper, cordage, borax, sulphur, gunpowder, saltpetre, fire-arms, coarse porcelain, English glass-ware, opium, tobacco, cocoa and areca nuts, sugar, and spirits. Crawfurd estimated the value of the imports before 1823 at 300,000*l.*, and that of the exports at the same sum. According to a census taken by Crawfurd in 1826 the town and suburbs contained a population of 8666 individuals, exclusive of strangers.

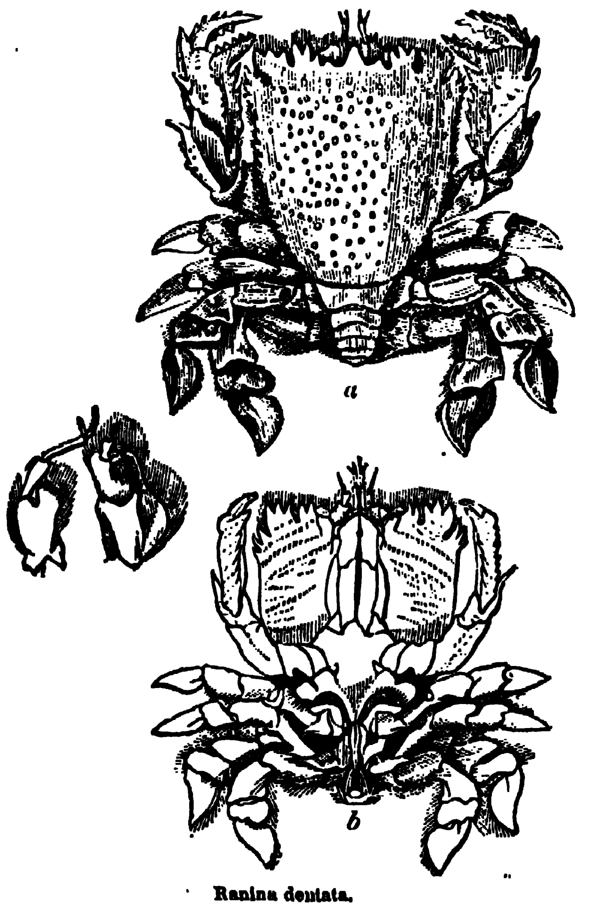
(Symes, *Account of an Embassy to the Kingdom of Ava;* Snodgrass's *Narrative of the Burmese War;* Crawfurd's *Journal of an Embassy to the Court of Ava.*)

RA'NIDÆ. [Frogs, vol. x.] The reader should refer to Mr. Bell's interesting *History of British Reptiles*, where the experiments of Edwards proving the existence of cutaneous respiration in the frog after the possibility of communication with the lungs was prevented, are recorded, and many very valuable remarks are concentrated.

RANINIANS, the name by which M. Milne Edwards designates the fourth tribe of the family *Apterura*, belonging to the section of Anomourous Decapod Crustaceans.

This tribe, in its general form and in the conformation of its feet, approaches very closely to the Hippians, and especially to the *Albuneæ*. [Hippa.]

The *carapace* of the *Raninians* is convex laterally, nearly straight from before backwards, wide and truncated anteriorly, and gradually narrowed backwards. The ocular peduncles are lodged in the orbits, but are bent (coudés), and composed of three moveable pieces. The *internal antennæ* have no fossets, and are not capable of bending themselves back under the front; the external antennæ are very short and very stout at their bases. The external *jaw-feet* are very much elongated, but not pediform, and behind their insertion the pterygostomian regions of the carapace unite themselves to the sternal plastron, without leaving any aperture for the entry of the water into the branchial cavity. The sternal plastron is very large anteriorly, but becomes linear between the third or fourth last pair of feet. The anterior feet are very much compressed, and their immoveable finger projects but very little, so that the moveable finger is bent back against the anterior border of the hand, nearly as in the subcheliform feet. The succeeding feet are all flattened, very wide, and terminated by a great lamellar joint, like that of the natatory feet of the swimming *Brachyura* · the two last pair are inserted more or less high above the preceding, above which they bend themselves back. The abdomen is very small, and in the male does not even cover the appendages fixed near its base. (M. E.)



Ranina dentata.

a, seen from above; b, seen from below.

M. Milne Edwards makes this tribe consist of three genera, thus characterized:—

Raninians having the sternal plastron.	Linear between the base of the feet of the second pair.	Carrying on the external border a great auriculiform prolongation.	Ranina.
	Second joint of the external antennæ	not enlarged externally.	Ranilia.
	Very wide between the base of the second pair of feet, which are widely separated from the third pair.		Raninoïdes.

Ranina dentata may be taken as an example of the tribe.

Locality.—The Indian Seas; Isle of France.

Habits.—Rumphius states that it comes to land, and creeps even to the tops of houses (sur le faîte des maisons). (M. E.)

M. Milne Edwards remarks that the *Cancer dorsipes* figured by Rumphius, and confounded by most modern authors with *Raninoïdes lævis* and *Albunea Symnista*, appears to belong to this genus.

In the neighbourhood of this tribe M. Milne Edwards would place *Eryon Caribensis* of Fréminville (*Ann. des Sciences Nat.*, 1st series, tom. xxv., p. 275, pl. 8, B).

Fossil Raninians.

The fossil designated by Ranzani as *Ranina Aldrovandi* belongs, in the opinion of M. Milne Edwards, to the tribe of *Raninians*, and may be referred to the genus *Ranina*.

RANSOM, a word common to the French (rançon) and English languages, the sense of which is a sum of money paid for the redemption of a captive.

The paying of ransoms is an event of frequent occurrence in the middle-age history, and indeed may be traced in the history of the older nations. Nothing appears on the first view more reasonable, or would more naturally arise out of the relations of two parties in a state of hostility, than that compensation of some kind should be made for the restoration of prisoners, which compensation was most easily estimated and discharged by means of the common medium of exchange. In modern warfare we hear little of ransoms. It rarely happens that a person is taken captive whom it is of importance to redeem; and when prisoners are to be redeemed, it is usually done by way of exchange, and those who remain over, at the conclusion of a war, are usually delivered up as a part of the concession of the party in whose favour the difference is found to be.

In the indentures of military service in the middle-age period, as in the wars of Henry V. for instance, it was a usual stipulation that, while the ransom of persons of inferior condition taken in the war was allowed to those by whom they were captured, the ransom for persons of rank was to belong to the king.

The ransoms demanded for persons of eminence were often very large sums of money; so much beyond the power of any family, however great, to command by the ordinary resources, that the persons who held lands of them were called upon to contribute in proportion to the extent of land held. It was one of the three casual occasions of expense when this kind of extraordinary aid was demanded as of prescriptive right by the lord; the other two being on occasion of knighting the eldest son, and of marrying the eldest daughter. In France these casual payments were required of the tenant on other occasions.

The ransom paid for King Richard I., when he was a captive in the hands of the emperor Leopold, was no less a sum than 100,000*l.* To raise this sum an aid of twenty shillings was required of each knight's fee, and the clergy contributed liberally. This was the only occasion on which England had to pay for the redemption of its king. The ransom of David Bruce, king of Scotland, in the reign of Edward III., was 100,000 marks, which sum was paid by instalments, usually of 4000*l.* By the treaty of Bretigny it was stipulated that a sum equal to 500,000*l.* should be paid to King Edward III., which was in fact the ransom money for John, king of France, his prisoner. These three are the most remarkable ransoms in English history.

RA'NULA is a tumour formed beneath the tongue, and probably resulting from an obstruction of one or more of the ducts of the sublingual salivary glands. The tumour is usually of a rounded form, with a smooth polished surface similar to that of the adjacent mucous membrane. When small, such a tumour produces so little inconvenience, that it is usually not discovered till it has existed for some time. As they increase in size however, these growths, though seldom attended with pain, produce great inconvenience, by obstructing all the movements of the tongue. They usually burst when they have attained the size of a walnut, but they sometimes continue to increase beyond this size, and have been seen large enough to contain a pint of fluid. Their most usual contents are a transparent yellowish viscid fluid, resembling in consistence the white of an egg; sometimes however the material within them is much thicker, and sometimes mixed with portions of earthy matter, similar to the larger masses by which the salivary ducts are occasionally blocked up.

The treatment of Ranula consists in making a free incision into the front of the tumour, so as to let out all its contents. Means must then be adopted to prevent the edges of the wound from uniting again; and the best plan for this purpose is to rub the surface of the cyst with nitrate of silver (lunar caustic). If the wound be not prevented from uniting, the tumour will form again, and the same proceedings must again be adopted for its cure.

RANUNCULA'CEÆ form a tribe of plants founded on the common crowfoot, or buttercup, but embracing a large variety of different structures within its limits. The essential character of this order is to have numerous indefinite stamens growing from below the pistil, disjoined carpels, a minute embryo lying in abundant albumen, and an annual, or at least nearly herbaceous stem. Great numbers of species answer to this description, and, when combined, form a very natural assemblage. All are more or less acrid and poisonous, and some vehemently so, as aconite and hellebore; others are beautiful with their gay flowers, as the pæony, ranunculus, larkspur, and columbine: many however are mere weeds. The most striking variation that takes place from the usual form of this order is when the calyx or corolla becomes unusually formed, and more or less imperfect. When this occurs, as in larkspur and aconite, the general resemblance of such plants to the regular portions of the order is much obscured. Occasionally the petals are not present, as in clematis, and thus additional evidence is afforded of the comparative unimportance of petals in forming the great suborders of Exogens.

RANZ DES VACHES ('Kuhreihen' in German) is the name of certain simple melodies which are great favourites with the mountaineers of the Alps of Switzerland, and which are commonly played upon a kind of long trumpet called the Alp-horn. The sounds of these tunes, as well as the words which are set to them, are expressive of the scenes and business of pastoral life; the hut, the roaring torrent, the bellowing of the cattle, and the tinkling of the bells which are suspended from their necks; and the associations which they thus recall to the minds of the natives when they are in foreign countries, often produce that unconquerable longing for home which is said to have been especially remarked among the Swiss soldiers on foreign service; for this reason, the bands of the Swiss regiments in foreign service were forbidden to play the Ranz des Vaches. Theodore Zwinger, of Basle, wrote, in 1710, a 'Dissertation on Nostalgia,' in which he gave the music of the Kuhreihen of Appenzell, which is one of the oldest, and which was introduced into England in the time of Queen Anne, who had it often played by her band. The words begin thus: 'Wänder iha, wänder iha, wänder iha, Lo....ba, Alsamma mit nama, alsamma mit nama, die alten, die jungen, die alten allsamma, Loba, Loba, Loba.' Each of the various pastoral districts, the Oberland, the Emmenthal, the Entlibuch, the Appenzell, has its Kuhreihen. The western or Romand districts of Switzerland have their Ranz des Vaches in their respective patois or dialects. The following is a specimen of that of Gruyères in the canton of Fribourg: 'Lé-z-armailli dei Colombette—Dé bon matin sé san leha—Ha ah! Ha ah!—Liauba, Liauba, por arià—Vinidé tote—Bliantz et nairé—Rotz et motailé,' &c.

In recent times the words of the original Ranz des Vaches have appeared too rude to refined ears, and more sentimental expressions have been substituted. This is the origin of the pretty air which is often heard in the societies of the Swiss towns, 'Quand reverrai-je un jour—tous les objets de mon amour? nos clairs ruisseaux, nos coteaux, nos hameaux, nos montagnes,' &c., which reminds the English hearer of his own 'Home, sweet home.'

A collection of the various Ranz des Vaches and other Swiss airs has been published: 'Sammlung von Schweizer Kuhreihen and Volksliedern,' Bern, 1818. Tarenne has written 'Recherches sur les Ranz des Vaches,' Paris, 1813. See also Laborde, 'Essai de la Musique ancienne et moderne;' and Ebel, 'Schilderung der Gebirgsvölker der Schweiz.'

RAPA'CES, M. Temminck's name for the *Birds of Prey*. [RAPTATORES; RAPTORES.]

RAPE is defined to be the having unlawful carnal knowledge of a woman by force and against her will; and it is a capital felony. It is doubtful whether fraud is equivalent to force for the purpose of constituting this offence: as where a man takes advantage of circumstances which induce a woman to suppose he is a husband; but if he obtains her consent by menacing her with death, or by duress, it is clearly rape. A person under fourteen years of age is in law presumed to be incapable of perpetrating this offence: this presumption however is based on physical grounds entirely, so that such a person, by assisting others of maturer age, may render himself liable to the full penalty of the law as a principal in the second degree. In the case of a female under ten years of age, whether the act takes place with or without her consent, it is equally punishable as rape; if she be above ten and under twelve years of age, her consent reduces the act to a misdemeanour punishable by imprisonment and hard labour for such term as may be awarded.

An assault with intent to commit a rape is a misdemeanor punishable by imprisonment for any term not exceeding two years, and with or without hard labour, at the discretion of the court before which the offender is convicted. Upon a trial for the capital offence, where the evidence is incomplete, the prisoner may be convicted of a misdemeanor.

RAPE. This plant, which is of the cabbage tribe, is cultivated like cole, or colza, for the sake of its seeds, from which oil is extracted by grinding and pressure. It is also extensively cultivated in England for the succulent food which its thick and fleshy stem and leaves supply to sheep when other fodder is scarce.

The mode of cultivation of the colza and rape for seed is nearly the same. The colza takes a longer time to come to maturity, and produces more seed. The rape grows on less fertile soils, and may be sown in spring as well as in autumn. Both are hardy, and resist the winter's frost.

The colza (Brassica oleracea, or campestris) is a plant which grows with a strong branching stem, three or four feet high, and requires room to spread; the plants are therefore raised in a seed-bed, and transplanted when they have acquired a certain size. When rape (Brassica napus) is cultivated for the seed, it is treated in the same manner; one description will therefore serve for both.

The seed-bed, where the cultivation is on a small scale, is usually prepared by digging or trenching with the spade, in a good loamy soil, neither too sandy nor too wet. A large proportion of rotten dung is spread evenly over it, and dug in six inches deep, and the surface is raked fine. The seed is sown broad-cast or in drill; the latter is the best method: it is then slightly covered with the rake; and if the ground will allow of it, without risk of its being bound too hard in case of dry weather, it is well rolled or trod with the feet. The seed must not be sown too thick; and the plants, as soon as they have six leaves, must be thinned to a distance of four or five inches in the rows, which will make them stronger and better furnished with roots. One acre of seed-bed will furnish plants for ten acres or more. The seed is sown in July or August, that the plants may not run to seed the same year, which they are apt to do if sown early; and they are transplanted in September or October, on land which has already borne a profitable crop. As this crop is a substitute for a fallow on rich heavy land, too much pains cannot be taken to keep it free from weeds. Winter barley, and rye, which are reaped early in July, are very proper crops to be succeeded by rape or colza. The stubble should be ploughed two or three times, to pulverise and clean it. A good coat of rotten dung should be put on, and the land ploughed in ridges, as for turnips: the plants should be put in on the ridges ten inches apart. It requires great care in taking them up not to break the fibres of the roots: they should be raised with a fork, and placed gently, with the fine earth adhering to them, in flat baskets, and in a slanting position, so that the tops may be upwards. In planting, the holes should be made with a large thick dibble, that the plants may be introduced without doubling up the principal roots or breaking the fibres. The earth should be pressed to the root by a short dibble, inserted to the right or left of the hole made by the first dibble; or, which is better in stiff soils, a hole should be made with a narrow hoe of sufficient depth to allow the plant to be placed in it, and another hoe should follow to draw the earth to the plant. Thus two men with hoes, and one woman, will plant a row more rapidly than could be done any other way: the man who fills up the holes places his foot by the side of each plant as he goes on, to press the earth to the roots.

An expeditious mode of planting rape is used in Flanders. A spade ten inches wide is pushed vertically into the ground, and, by drawing the handle towards his body, the labourer makes a wedge-like opening; a woman inserts a plant in each side in this opening, and when the man removes the spade, the earth falls back against the plants. The woman puts her foot between the two plants, and they are then fixed in their places. In this operation the man moves backwards; and the woman, who puts in the plants, forward. Instead of the spade, an instrument is also used called a *plantoir*. It consists of two sharp-pointed stakes a foot or more apart, connected by a cross-handle at top, and a bar at about eight or ten inches from the points. The instrument is pressed into the ground by the handles, assisted by the foot placed on the lower bar, and makes two holes, a foot apart, into which the plants are placed, and earthed round as before. This is done when the land has not been laid up into high ridges.

When a large field is to be planted, a more expeditious mode is adopted; and this is the most usual practice in Holland and Germany. The land having been prepared, and the manure well incorporated, a deep furrow is drawn with the plough; women follow with baskets of plants, which they set, a foot apart, slanting against the furrow slice. When the plough returns, the earth is thrown against these plants; and a man or woman follows, who, with the foot, presses the earth down upon the roots. Sometimes plants are put into each furrow, which is then ten inches or more wide; but the best cultivators put them only in every alternate furrow. In this case also there are no ridges. The season of the year affords sufficient moisture in the north of Europe to ensure the growth of the plants; and if they have escaped the fly in the seed-bed, they are now tolerably safe. No further attention is requisite till spring. The weeds are then carefully extirpated by hand and hoe; and where the distance of the plants admits of it, the light plough stirs the ground between the rows, throwing the earth towards the stems; yet so as to leave each plant in a little basin to catch the water and conduct it to the roots. When the plants are invigorated with rich liquid manure, such as night-soil mixed with water, or the drainings from dunghills, they become extremely luxuriant; and every trouble or expense bestowed upon them is amply repaid. The difference between a crop partially neglected and another carefully cultivated often exceeds fifty per cent.

A moderate return of seed for colza is thirty bushels per acre, but it frequently exceeds fifty. The value on the Continent is nearly the same as that of wheat. In England it is somewhat less, owing to the quantity imported, on which there is a fixed duty of 10*s*. per quarter. It is usually sold by the last of ten quarters.

There is not much difference between the value of colza and rape-seed (called *navette* in French): but the latter produces less. When the rape is transplanted before winter, it is much more productive than when sown in spring. In the latter case it produces seed the same year. It is sown in drills, and thinned out by the hoe, and in favourable seasons a tolerable crop is obtained. It is generally sown on land which could not be brought into a proper tilth after harvest, and which would require the frost of winter to mellow it.

Great crops of cole-seed and rape have been produced in the fens of Lincolnshire and the alluvial soils in Essex, by merely paring and burning the surface and ploughing in the ashes; and these crops, alternating with oats, have in many instances so exhausted the soil as to cause a great prejudice against them in the minds of the landlords. Many leases have a clause prohibiting its cultivation, except to be eaten green by sheep. The principal cause however of the diminution of this crop in England is the inferior price obtained for the seed when compared with wheat, which can be raised on the same land, and is a more certain crop.

The rape and colza ripen their seed very unequally. The lower pods are ready to burst before those at top are full. If the season is wet at harvest, much of the seed is lost; and, without great attention, some loss is sustained in the most favourable seasons. It should be cut when the dew is on it, and moved as little as possible. If the weather permits, it is threshed out on a cloth in the field, and as many threshers are employed as can be conveniently collected, that no time may be lost, when the weather is fair. The seed is spread out on the floor of a granary that it may not heat, and is turned over frequently. It is then sold to the crushers, who express the oil. The pods and small branches broken off in threshing are much relished by cattle. This crop returns little to the land, and is of itself very exhausting. Not so however is the rape, when sown as food for sheep. It is, on the contrary, a valuable substitute for turnips, upon land which is too wet and heavy for this root. The Brassica oleracea is more succulent than the Brassica napus. Its stem is not so hard, and the soft pith which it contains is much relished by every kind of live-stock. To have it in perfection, the land should be prepared and manured as for turnips. The rape should be sown in drills ten inches apart, about the beginning or middle of August, which gives ample time for preparing the land, without interfering with the turnip crop. It will be sufficiently forward before winter, and it should then be hoed over once. If the crop is very forward, it may be slightly fed off: but, in general, it is best to let it remain untouched till spring. In the end of March and beginning of April it will be a great help to the ewes and lambs. It will produce excellent food till it begins to be in flower, when it should immediately be ploughed up. The ground will be found greatly recruited by this crop, which has taken nothing from it and has added much by the dung and urine of the sheep. Whatever be the succeeding crop, it cannot fail to be productive; and if the land is not clean, the farmer must have neglected the double opportunity of destroying weeds in the preceding summer and in the early part of spring. If the rape is fed off in time, it may be succeeded by barley or oats with clover or grass seeds, or potatoes, if the soil is not too wet. Thus, no crop will be lost, and the rape will have been a clear addition to the produce of the land. Any crop which is taken off the land in a green state, especially if it be fed off with sheep, may be repeated, without risk of failure, provided the land be properly tilled; but where cole or rape have produced seed, they cannot be profitably sown in less than five or six years after on the same land.

When the oil has been pressed out from the seed, the residue (which contains a portion of starch and mucilage not changed into oil) and the husk of the seed form a hard cake known by the name of rape cake. This is used on the Continent to feed cows and pigs with, as we use the linseed cakes; but it is also much used as a rich manure, and for this purpose it is imported in large quantities. When rape cake is ground to a powder and drilled with the seed on poor light lands, it supplies nourishment to the young plants, and greatly accelerates their growth; but if it be added in a large proportion in immediate contact with the seed, on heavy impervious soils, it often undergoes the putrid fermentation, which it communicates to the seed sown, and, instead of nourishing, destroys it. In this case it is useful to mix it with some dry porous earth or with ashes, which will prevent the too rapid decomposition. Dissolved in water and mixed with urine, it forms one of the most efficacious of artificial liquid manures. Hence it is probable that the most advantageous mode of using it on the land, after it has been dissolved in the urine-tank, is to apply it by means of a water-cart to the rows where the seed has been already drilled, or some time before it is put in. Where flax is to be sown, this mixture applied a few days before the seed is sown, so as to allow it to sink into the soil, is considered in Flanders as next in value to the emptyings of privies, which with them hold the first rank, for producing fine crops of flax. When a crop appears sickly, and not growing as it should do, owing to poverty in the soil, a top-dressing of rape-cake dissolved in water, if no urine is at hand, will in general excite the powers of vegetation; and it is highly probable that it may greatly assist the effects of saltpetre or of nitrate of soda, where these salts are applied. The cultivation of rape or cole for spring food cannot be too strongly recommended to the farmers of heavy clay soils.

RAPHAEL, or RAFFAELLO SANZIO, was born at Urbino, on Good Friday, March 28, 1483. He was the son of Giovanni de' Santi, a painter of merit in that city, some of whose works still exist. A specimen of them may be seen in the Berlin Gallery (No. 215, first division), bearing the name of Giovanni, and showing considerable beauty, but with weak colouring. Although Raphael lost his parents before he was twelve years old, he imbibed the rudiments of art from his father. Other artists of that peculiar school which fixed itself in Umbria, such as Nicolo Alunno of Foligno, and Andrea Luigi of Assisi, probably exercised some influence over the young painter. At what age he became the pupil of Perugino we know not, but traces of the scholar's hand are supposed to be visible in several of the works of the master; among others in the frescoes of the Cambio at Perugia, which where painted about the year 1500.

The career of Raphael is usually divided into three periods, of which the first terminates with his visit to Florence, in the autumn of 1504; the second comprises the time from that date until he was invited to Rome by Julius II., about the middle of 1508; and the third extends to his death, in 1520.

1. To begin with the works executed before Raphael's visit to Florence. One of the earliest of these now extant is probably the Virgin with the Book, in the Berlin Gallery (No. 223, first division), and a still more important picture of this period is the Adoration of the Magi, in the same collection (223 a). The latter is executed on linen, in size colours ('*al guazzo*'), and was originally intended for the high altar at Ferentillo; it was purchased by the late king of Prussia, from the Ancajani family at Spoleto, for the sum of 6000 scudi, and has suffered a good deal from the peeling of some of the colours.

The pictures painted at Citta di Castello were, the Coronation of St. Nicholas of Tolentino (said to have disappeared from the Vatican during the French occupation); the Sposalizio, or Marriage of the Virgin (now in the Brera at Milan), and the Christ on the Cross, in the collection of Cardinal Fesch. Lanzi, on the authority of mere tradition, states that the first of these three was painted when Raphael was only seventeen, that is, in 1500, and he assigns the last to about the same time. Both probably approach very nearly in time to the Sposalizio, which bears the date of 1504. The Coronation of the Virgin (now in the Vatican) clearly shows the struggle of new principles, although Vasari, whose contempt for the simplicity of the earlier style led him to content himself with very general resemblances, refers to this picture as one of those which prove how closely Raphael imitated the manner of Perugino. Notwithstanding Vasari's assertion to the contrary, it seems probable that both the Coronation of the Virgin and the Crucifixion belonging to Cardinal Fesch were posterior to the Sposalizio.

Raphael's share in the frescoes executed by Pinturicchio, in the Libreria of the Cathedral at Siena, has been much exaggerated. There is little doubt that he never worked there in person, although he furnished some drawings to his fellow-pupil; two of these are yet extant, one in the Florence Gallery, and the other in the Baldeschi collection at Perugia. Vasari's whole account of Raphael's first visit to Florence is confused in the highest degree. He describes him as induced to quit Siena by the report of Leonardo's Battle of the Standard and of M. Angelo's Cartoon, although the latter work was not exhibited till 1506, while the frescoes of Pinturicchio were probably completed in 1503, and the date of Raphael's journey is fixed to October, 1504, by the letter of recommendation for the Gonfaloniere Soderini from the duchess of Sora. Quatremère de Quincy tries to solve the difficulty by assuming a visit to Florence in 1503, and another in the following year, but a strong presumption against this supposition is furnished by the total absence of all trace of Florentine principles in the Marriage of the Virgin. Susceptible of new impressions in art as Raphael afterwards showed himself, it is impossible that the first introduction to his great Florentine contemporaries should have left no trace in his works. Now the pictures of 1505 exhibit clear traces of a new influence. In fact, at the time of his arrival at Florence, art had just reached the point which enabled him to reap the fullest benefit from the new field thus thrown open. He studied the works of Masaccio, and became the friend of Fra Bartolomeo and Ridolfo Ghirlandaio. [PAINTING.] In the following year we find him employed again at Perugia. The fresco in San Severo, and the altar-piece for the Ansidei family (now at Blenheim) were painted in 1505. Whether the picture executed for the nuns of St. Antonio of Padua at Perugia, which is at Naples, be of the same or of a later date, is a disputed point. The separate portions of the 'Predella,' or step belonging to the latter picture, are in England, in the respective collections of Mr. Rogers, Mr. Miles of Leigh Court, and Mr. White of Baron Hill.

Four pictures of the Virgin and Child of Raphael's Florentine period are distinguished by different characters, though all exquisitely beautiful. The Madonna del Gran Duca, in the Pitti palace, is the most simple, and, to our judgment, the most admirable of them all. It still breathes much of the spirit of the Umbrian school. The other three are the Madonna Tempi at Munich, the Colonna Madonna at Berlin, and the picture in the possession of Lord Cowper at Panshanger. To the same time must be attributed the Madonna del Cardellino, in the Tribune at Florence, the Belle Jardinière at Paris, and the Holy Family with the Palm, in the Bridgewater collection. The first of these three was painted for Lorenzo Nasi. Raphael's power and fidelity as a portrait painter are well shown in the beautiful portraits of Angelo and Maddalena Doni, in the Pitti palace, and in two heads of monks, in the Academia at Florence. The St. Catherine, which passed from the Aldobrandini collection into that of Mr. Beckford, and still more lately into the National Gallery, was executed in the latter part of the artist's residence at Florence. The two works which must be considered as closing this division are the Madonna del Baldacchino, or di Pescia, left unfinished when the painter started for Rome, and the Entombment of Christ. The former picture bears some resemblance in its technical details to the works of Fra Bartolomeo; it is now in the Pitti palace. The latter was painted by order of Atalanta Baglioni, for S. Francesco at Perugia, and forms part of the Borghese collection. It is an elaborate composition, of the greatest beauty and power of expression, proving how much Raphael had profited by his Florentine studies. The figures from the Predella are in the Vatican.

The invitation given by Julius II. to Raphael would be sufficiently accounted for by the celebrity of the artist himself, although it is very probable that his connection with the family Della Rovere, or the favour of his fellow-countryman Bramante, facilitated his introduction at the papal court. He seems to have left Florence, rather suddenly, towards the end of the year 1508.

The 'Stanze' decorated by the pencil of Raphael were the living-rooms of the papal court in the time of Leo X. His frescoes suffered during the occupation of Rome by the imperial troops, in 1527, and by subsequent neglect, when the popes had transferred their residence to the Quirinal. In the years 1702 and 1703 they were cleaned and restored, by Carlo Maratti, who re-painted the larger portion of the decorative framework.

The Camera della Segnatura was the first worked on by Raphael. The figures of Theology, Poetry, Philosophy, and Justice on the ceiling preceded in execution the large paintings on the walls. Of these last the Disputa del Sacramento, as it is commonly called, was the earliest. In simple beauty and severe dignity, in energy and individual character, this work has never been surpassed; in technical excellence, and the picturesque qualities of breadth, composition, and softness, it is certainly inferior to the Parnassus and the School of Athens, which came next. The allegorical figures of Temperance, Fortitude, and Prudence, in the semicircular division on the remaining side of the room, are among the most beautiful of Raphael's designs.

In the Stanza d'Eliodoro, the fresco of Heliodorus, together with that of the Mass of Bolsena and the scripture subjects in the ceiling were executed in the pontificate of Julius. It is impossible to show more complete understanding of the application of painting to a story than Raphael has displayed in the first of these compositions. The colouring of the Mass of Bolsena is admirable.

In 1513 Leo X. succeeded to the papal chair. The two remaining frescoes in the Stanza d'Eliodoro, that is to say, Attila repelled from Rome, and the Liberation of St. Peter, belong to his reign. The latter is supposed to allude to the pope's escape, when Cardinal de' Medici, after the battle of Ravenna, and the former to the retreat of the French from Italy.

In the third room, or Stanza del Incendio, the ceiling contains some paintings of P. Perugino, which were spared when those of other masters were destroyed to make room for the works of Raphael. The subjects on the walls are the Burning of the Borgo, or suburb of Rome, the Victory over the Saracens at Ostia, the Coronation of Charlemagne, and the Death of Leo III. The execution of all these was more or less left to pupils; those in the Sala di Costantino were wholly painted by Julio Romano and others, from designs by Raphael.

The loggie, or open colonnades, designed by Bramante, were decorated under the directions of Raphael by his principal scholars. The Cartoons for the tapestry to be hung round the Sistine Chapel were prepared in 1515 and 1516, at the desire of Leo X. These cartoons were cut into strips for the convenience of the workmen at Arras. By some unaccountable neglect they remained in Flanders, and seven of the ten were, after the expiration of a century, bought by Charles I. at the suggestion of Rubens. When the property of the crown was sold by the Commonwealth, they were valued at 300*l.*, and purchased by Cromwell's order at that price for the nation. William III. caused these precious fragments to be properly mounted and put up at Hampton Court. In 1766 they were removed to Buckingham House; thence carried to Windsor; and in 1804 again restored to Hampton Court. The Cartoons have far greater pretensions to be considered as original works of Raphael than the paintings in the two last rooms of the Vatican just referred to. In composition they are unrivalled, and their whole conception is admirably adapted to the purpose which they were meant to fulfil. [CARTOONS.]

The Isaiah in San Agostino was probably painted in 1512 or 1513; and the Sibyls in Santa Maria della Pace shortly afterwards. Rumohr, on technical grounds, places the latter (one of the artist's most admirable works) about 1515. Their subjects and their mode of treatment sufficiently establish in a general sense that imitation of Michael Angelo of which so much has been said.

We must now return to the smaller works of Raphael.

Vasari says that his portrait of Julius II. was so like as to inspire fear, as if it were alive. The original thus spoken of is supposed to be in the tribune at Florence. Two copies of it are in the Pitti Palace, and one in our own National Gallery. The last came from the Borghese collection. On the subject of Raphael's own portrait a good deal of controversy has taken place. It is certainly difficult to detect much resemblance between the portrait in the Florence collection and that purchased by the king of Bavaria from the Altoviti family; and the expression of Vasari, 'à Bindo Altoviti fece il ritratto suo,' is ambiguous, but nevertheless we believe the picture now at Munich to be the work of Raphael, and his own portrait. Missirini and the Italians would probably have discussed the question with much less angry zeal if the picture had not been transferred to a foreign country.

Three portraits exist, which are believed to represent Raphael's mistress, the so-called Fornarina, painted by himself. One of these is in the Barberini, another in the Sciarra palace (at Rome), and the third is in the Tribune at Florence. This last picture bears the date of 1512, and was at one time attributed to Giorgione. Certain it is that the colour would be worthy of the Venetian master, and that the face and form are Venetian in their character.

The Madonna della Seggiola, the Madonna del Duca di Alba, and several others of somewhat similar feeling belong to the early part of Raphael's residence at Rome. The Madonna di Foligno, now in the Vatican, was painted for Gismondo Conti, probably about the time of the completion of the Camera della Segnatura. The Vision of Ezekiel is said to have been paid for in 1510; two pictures of the subject exist, one in the Pitti palace, and another, from the Orleans gallery, in the collection of Sir Thomas Baring. It is disputed whether either, and if either, which of these two is the original. Dr. Waagen prefers the claims of the Florence picture. The St. Cecilia at Bologna was ordered about 1510, and completed somewhat later; it has suffered greatly from restoration.

The four great altar-pieces of Raphael's later time are—

1. The Madonna del Pez, painted for San Domenico at Naples, and now (1833) in the Iglesia-Vieja of the Escurial. It is a composition of the purest and simplest beauty.

2. The Madonna di S. Sisto, the well known pride of the Dresden gallery. This picture has had the good fortune to be engraved better than any other in the world. It is painted on canvas, and Rumohr conjectures that it was intended for a 'drapellone,' or large standard, to be carried in procession, attached to two poles. A picture, by Guido, painted on grey silk, and called 'il pallione,' from being used in this manner, is to be seen in the Pinacoteca at Bologna (No. 138). The most striking points in the Madonna di S. Sisto are the deeply meditative anticipation of future suffering in the Virgin, and the superhuman character imparted to the Christ by the union of a childish form with the severe thoughtfulness of maturer age.

3. The Spasimo di Sicilia, executed for Santa Maria dello Spasimo, at Palermo, is now in the public gallery at Madrid. There is something academical in the figure of the executioner, but the deep feeling in the right-hand group of women reminds us of the Borghese entombment. This picture has suffered much by restoration, and has acquired a sort of brickdust colour.

4. The Transfiguration, usually considered to be Raphael's masterpiece. It was left unfinished at his death.

Besides the above-named works, we must allude to the Visitation and the Perla, both in the Sacristy of the Escurial. The latter formed part of the collection of Charles I. of England.

The Archangel Michael, and the Holy Family, painted in 1518, for Francis I., are first-rate pictures of the artist's later time. In the portrait of Leo X., with the Cardinals de' Medici and Rossi (painted not earlier than 1518), Raphael has shown that he could rival the Flemish masters in the accurate imitation of ordinary household objects. The Violin-Player, in the Sciarra palace at Rome, also bears the date of 1518. The portraits of Joanna of Aragon, Baltasar Castiglione, and others, we have not space to dwell on.

Raphael occupied himself with architecture as well as painting, and seems to have felt a zealous interest in all remains of antient art. The Psyche and the Galatea, executed in the Farnesina at Rome for Alessandro Chigi, are his principal works which represent mythological subjects.

On the 6th of April, 1520, being Good Friday, this greatest of all modern painters died of an attack of fever, at the age of thirty-seven.

All that is recorded of his public and private character represents him as most amiable, and as the object of sincere affection on the part of his immediate friends. As an artist he was especially distinguished in two things. In the first place, whatever was the principle of art which he adopted at different periods of his life, in each and all successively he attained the greatest excellence. In his early pictures the spirit of Perugino and of the Umbrian school beamed with double purity and beauty; but his powers were not limited within the narrow circle which hemmed in his master and caused him to reproduce the same forms and the same expression through the course of a long life. Raphael came to Florence at a fortunate moment. The anatomical studies of Leonardo and M. Angelo, and the powers of Masaccio, had exactly provided the fresh food for which his genius was craving. The religious feeling of his earlier works became a little unspiritualised in the worldly city of Florence, but his technical power received a great accession of strength, while his capacity for seizing real life is sufficiently shown by the portrait of Maddalena Doni. His Madonnas at this time lose something of their thoughtful melancholy, and often acquire a smiling character, such as we find in the works of Leonardo. Still his pictures exhibit excellence peculiar to himself.

In his third period, many persons, like Monsieur Rio (*l'Art Chrétien*), may consider the 'Disputa' as the last gleam of primitive simplicity or beauty. It may be said that thenceforth the Christian painter became paganised by contact with the heathen courts of Julius II. and Leo. X It is true that at this particular time a change took place in the style of art adopted by Raphael. He had acquired a new sense for the effect of masses in his drapery and in his lights and shades, and he worked on principles more consonant with the modern notions of picturesque composition Which of the two sources of pleasure from painting is the purest and the most genuine may be a subject of dispute; but there can be no dispute as to the fact that in each line, as he successively adopted them, Raphael attained the highest pitch of excellence of which they respectively admitted We cannot however allow that an artist who could execute the Cartoons had lost the power of conceiving and worthily embodying Christian subjects

The second consideration which seems to place Raphael before all other painters is the fact that of the large number of works attributed to him with any certainty, hardly one can be called ordinary or commonplace in its character. If we consider the early age at which he died, his pictures are very numerous. The best of them are confessedly superior to the finest productions of other masters, and their average quality is in a still greater degree superior to the average quality of the works of any other painter.

(Vasari, *Vita dei Pittori*, vol. iii.; Lanzi, *Storia Pittorica*; Quatremère de Quincy, *Vita di Raffaello, tradotta da Longhena*; Rumohr, *Italienische Forschungen*, vol. iii.; Bunsen, &c., *Beschreibung der Stadt Rom.*, vol. ii.; Waagen, *Kunstwerke und Künstler in England und Paris*; Passavant, *Rafael von Urbino*; *Quarterly Review*, No. cxxxi.; Rio, *L'Art Chrétien*.)

RA'PHANUS, a Brassicaceous or Cruciferous genus of plants, is only remarkable for containing the common radish, Raphanus sativus. This plant, a native of China, has been cultivated in this country for upwards of 250 years, and has given rise to numerous varieties, which are divided into long-rooted or spindle-shaped, and round or turnip-rooted. They are also denominated spring, summer, autumn, or winter radishes, according to the season in which the respective sorts are found best adapted for use.

The *Scarlet* or *Salmon-coloured*, and the *Radis rose demi-longue*, are the best for early sowing; the latter variety is very tender and of a fine bright colour. The purple, another early long-rooted variety, is sometimes sold under the name of *Salad Radish*, the seed-leaves being larger and consequently better adapted for small salading than those of the other varieties. With the colour of the preceding sorts, the *Long White Transparent* will form an agreeable contrast. Of the round or turnip-rooted varieties, the *Early White Turnip-rooted* and the *Purple Turnip-rooted* are the best. The *Yellow Radish* succeeds in hot weather, being fit for use when the earlier kinds are apt to run to seed; and it precedes the autumn and winter varieties, of which the following is the order of succession: *Round Brown*, *White Spanish*, *Oblong Brown*, *Black Spanish*, and *Purple Spanish*. None of these are however esteemed in this country, where they are generally unknown.

If the early white turnip-radish be sown in August, it will come into use in autumn. The principal sowings should however be made in January and February, and successionally till May. The winter varieties require to be sown in July. In cold frosty weather the beds should be protected by straw, as is commonly practised, or by such other efficient means as may be at command. The covering should be always dispensed with when the days are fine; but it ought to be replaced before the cold of night ensues. Radish seed-pods are sometimes pickled, whilst tender, and may be used instead of capers, when the latter cannot be obtained.

RAPHOE, a city in Ireland, in the parish and barony of Raphoe, in the county of Donegal in Ulster, 145 miles north-west of Dublin, through Drogheda, Monaghan, Omagh, and Lifford. The parish comprehends 34,356 statute acres, chiefly land of good quality. The population, in 1831, was 1408 for the town, and 4819 for the rest of the parish making a total of 6227, chiefly agricultural. The town (which derived its early importance from a monastery, founded, it is said, by St. Columb, and afterwards made the seat of a bishopric) consists of three small streets meeting in the market-place. There is a neat market-house. The cathedral is also the parish church; it is a plain cruciform building, with a square tower, which was added about a century ago. The date of the erection of the church is not known. There is a handsome and spacious episcopal palace at a short distance from the town. The Presbyterians have a meeting-house in the parish.

There is a market on Saturday for provisions and occasionally a little linen-yarn: the markets on the first Saturdays in January, February, March, April, and December, are great markets: there are several yearly fairs. There are petty-sessions every fortnight, and a body of the county police are stationed here.

The population, in 1834, comprehended 1149 persons belonging to the Establishment, 2730 Catholics, and 2552 Presbyterians. The congregations at the church and the Presbyterian meeting-house were increasing. The benefice is a rectory, the average gross yearly income of which for the three years ending with December, 1831, was 1050*l*., exclusive of fines on the renewal of leases the glebe, the value of which is included in the above return, comprehends about 209 or 210 statute acres; the average net income was 771*l*.; the living constitutes the corps of the deanery of Raphoe.

There were in the parish, in 1835, ten day-schools, with a total of 505 scholars, viz. 332 males and 173 females; and four Sunday-schools. Among the day-schools were a royal endowed school with 27 boys, a national school with 70 boys and girls, and four hedge-schools.

RAPHOE, DIOCESE OF, one of the bishoprics of the ecclesiastical province of Armagh. It is bounded on the north and west by the Atlantic, on the east by the diocese of Derry, from which it is separated in one part by Lough Swilly, and in another part by the river Foyle; and on the south by the diocese of Clogher. It comprehends part of the county of Donegal. The dimensions of the diocese, as given by Dr. Beaufort, are 44 Irish or 56 English miles in length, and 32 Irish or 40 English miles in breadth; the area at 515,250 acres Irish, or 827,779 acres (1293 square miles) English measure.

The time when the diocese was established is unknown. Bishops of Raphoe are mentioned in the ninth century. The cathedral has been already described. [RAPHOE.] The chapter consists of the dean, the archdeacon, and four prebendaries. The gross revenue of the bishopric for the three years ending with December, 1831, was 5787*l*. 8*s*. 2*d*.; the net revenue, 5052*l*. 11*s*. 2*d*. The bishop presents to one of the dignities, three of the prebends, and twelve other benefices.

In 1792 the number of parishes was stated by Dr. Beaufort to be 31, of benefices 25, of churches 32, and of glebe-houses 17. By the Returns made to parliament in 1835 by the Commissioners of Public Instruction (*Parl. Papers* for 1835, vol. xxiii.), the number of benefices was 34, two of them unions of two or more parishes; the number of churches 34, and of other places of worship of the Establishment 7. The diocese was estimated to contain 33,507 members of the Established Church, 145,385 Roman Catholics, 28,914 Presbyterians, and 24 other Protestant Dissenters. There were 36 Catholic chapels, 27 Presbyterian meeting-houses, and 14 other places of worship not of the Establishment, chiefly belonging to the Methodists, who, in the account of the population, are classed among the members of the Established Church.

By the Returns of the same Commissioners (*Parl. Papers for* 1835, vol. xxiv.) there appear to have been in the diocese 263 day-schools, with about 14,500 scholars: of these schools 127 were wholly supported by the payments of the children, and 136 were wholly or partly supported by endowment or subscription. Only four were in connection with the National Board. The number of children under instruction was 6·98 per cent. of the whole population; this was considerably under the average of the dioceses of the province of Armagh, and also below the average of all Ireland.

This diocese has, by virtue of the Act 3 and 4 Will. IV., c. 37, been united to the diocese of Derry. In the Roman Catholic division of Ireland, the diocese is co-extensive with that of the Established Church. The cathedral and the bishop's residence are at Letterkenny, not far from Raphoe.

RAPHUS, Brisson's name for the Dodo. [DODO.]

RAPI'N, PAUL DE, a younger son of Jacques de Rapin, Sieur of Thoyras, was born at Castres, in 1661, of a Protestant family which came originally from Savoy. He studied in the Protestant College of Saumur, and afterwards entered the profession of the law. But the revocation of the Edict of Nantes by Louis XIV., in 1686, drove him from his native country, and he went first to England and afterwards to Holland, where he entered the service of William of Nassau as a volunteer. He accompanied William to England in 1688, was made an officer in an English regiment, served in Ireland under General Douglas, and was wounded at Limerick. Not long after, he was appointed travelling tutor to the young duke of Portland, with whom he spent several years. Having completed his engagement, he retired with his wife first to the Hague, and afterwards, for the sake of economy, to Wesel, where he commenced his great work, the 'History of England,' which occupied him for seventeen years. The application requisite for this undertaking is said to have exhausted his frame, and he died at Wesel in 1725. His work is entitled

'Histoire d'Angleterre depuis l'Etablissement des Romains jusqu' à la Mort de Charles I.,' 8 vols. 4to., La Haye, 1724, and foll. It was continued by others down to the accession of George II. The work was translated into English by Nicholas Tindal. This translation went through various editions; that of 1757-9 consists of 21 vols. 8vo., and is enriched with additional notes and a biography of Rapin. Rapin writes with spirit and ease; he quotes his authorities; and his work was the only complete history of England existing at the time of its appearance. Some French critics have accused him of partiality and of being unjustly severe upon his native country, which they attribute to the impression produced upon him by the persecution of his fellow-Protestants by Louis XIV. But this is a vague assertion, unless substantiated by facts. Rapin wrote also a 'Dissertation sur les Whigs et les Torys.'

RAPTATO'RES, Illiger's name for his third order of birds, comprehending the *Birds of Prey*.

His *Raptatores* consist of the following families and genera:—

Nocturni.—*Strix*.
Accipitrini.—*Falco*, *Gypogeranus*, *Gypäetus*.
Vulturini.—*Vultur*, *Cathartes*.

This order is placed by Illiger between the *Ambulatores* and *Rasores*.

The *Accipitres*, Linné's first order, include the genera *Vultur*, *Falco*, *Strix*, and *Lanius*.

RAPTO'RES, the name assigned by Mr. Vigors to the *Birds of Prey*. [RAPTATORES.]

The *Raptores* of Mr. Vigors form his first order, and the following families are arranged by him under it:—VULTURIDÆ, FALCONIDÆ, STRIGIDÆ, *Gypogeranidæ?*

The *Raptores* of Mr. Swainson comprise the families of *Vulturidæ*, *Falconidæ*, and *Strigidæ*.

Mr. G. R. Gray also makes the *Raptores* consist of the families *Vulturidæ*, *Falconidæ*, and *Strigidæ*.

RAREFACTION is an augmentation of the intervals between the particles of aeriform fluids, so that the same number of particles are made to occupy a volume greater than that under which they were previously contained. The term is used in opposition to condensation, and in the same sense as dilatation, which last is applied both to fluids and solids. Rarefaction or dilatation is caused by a repulsive power existing either in the particles of bodies or in those of the caloric between them, by which power the particles are made to recede from one another when not prevented by some external resistance.

The experiments of Lavoisier and Laplace have shown that, between the temperatures of freezing and of boiling water, the dilatations of all metals and of the fluids called non-elastic are constantly proportional to the increments of temperature; but beyond the temperature of boiling water, the experiments of Dulong and Petit indicate that the dilatations increase in a higher ratio. A remarkable circumstance is observed in the state of water when near congelation. On being cooled to a temperature within the limits of 33·9° and 34·5° (Fahrenheit), its volume remains stationary, and in this state water seems to have attained its maximum of density; for, on continuing the cooling process, the water begins to expand, and it continues to do so until it is converted into ice.

From the experiments of M. Gay-Lussac and Dr. Dalton it has been ascertained that, under equal external pressures, the rarefactions of all dry gases and of the aeriform substances produced by the evaporation of liquids are equal at equal temperatures, between the points of freezing and boiling water, and that they vary in volume proportionally to the increments of heat expressed by the expansions of mercury in the thermometer. [HEAT, p. 89, col. 1; GAS, p. 84, col. 1; and PNEUMATICS, p. 295, col. 1.]

The density or closeness of the aerial particles in any given portion of the atmosphere depends on the pressure or weight of the column of air above the given point; and by the law of Boyle or Mariotte, whatever be the temperature, provided it be constant, the density is proportional to the pressure; or, conversely, the rarefaction is inversely proportional to the pressure. It has been proved [PNEUMATICS] that the densities of the strata of air decrease upwards in a geometrical progression when the altitudes of the strata increase by equal increments; and this is equivalent to saying that the rarefactions of the air at such altitudes increase in a geometrical progression. Now if A be any point on the surface of the earth, and C any point above it, the formula

$$AC\ \text{(in fathoms)} = 10670 \times \log.\frac{\textit{density at A}}{\textit{density at C}}\ \text{[PNEUMATICS]}$$

will afford the means of computing the rarefaction of the air at any point C, when its height above A is given. But if the density at A be considered as unity (the temperature being =55°) the equation may be transformed into

$$\frac{AC}{10670}\left(= \log.\frac{1}{\textit{density at C}}\right) = \log.\ \textit{rarefaction at}\ C,$$

in which, substituting for AC any given value in fathoms, the rarefaction may be found. For example, let AC=3212 fathoms (=3·65 miles); then the second member of the equation will become ·30103 (=log. 2), which shows that at the height of about 3⅔ miles the rarefaction of the atmosphere is twice as great as at the surface of the earth; and by forming the progression of heights—

0 , 3·65 , 7·3 , 14·6, &c. in miles,

we have for the corresponding rarefactions—

1 , 2 , 4 , 8, &c.

A formula for the rarefaction of the air in an air-pump, after any number of strokes of the piston, is given near the end of the article PNEUMATICS.

The limits to which rarefaction may be carried are unknown, but the experiments of Mr. Boyle and others have proved that, by simply removing the external pressure, air may be so rarified that a given volume of the same density as at the surface of the earth will occupy a volume more than 13,000 times as great. It has been however discovered that at very high degrees of rarefaction the elasticity of the air decreases in a higher ratio than the density; and this may serve to prove that rarefaction cannot take place to an infinite extent.

RASAN. [RIASAN.]

RASA'RIUS, or, more properly, **GIAMBATISTA RASARIO**, an Italian physician, was born of a noble family, in 1517, in the province of Novara, in the Sardinian territories. After having studied at Milan and Pavia, he took the degree of doctor of medicine at the university of Padua. Upon his return to Milan, his learning soon gained him so great a reputation, that the republic of Venice invited him to their city, where he was professor of rhetoric and the Greek language for two and twenty years. Here he distinguished himself by his eloquence, particularly on occasion of the battle of Lepanto, 1571, when, at the command of the doge, and with a very short time for preparation, he pronounced in the church of St. Mark a public oration that has been several times printed. (See vol. iii., *Orat. de Bello Turcico per Nic. Reusnerum*, Lips., 4to. 1596.) He afterwards went to Rome, where the pope, Pius IV., made him the offer of some good appointments, which however he thought fit to decline, as he did not like a residence in that city. He chose rather to accept the office of professor of rhetoric at Pavia, where he died about four years after, in 1578, at the age of sixty-one. His works consisted principally of editions and translations of various Greek writers, such as:—'Galeni Comment. in Hippocr. libr. ii. et vi. Morb. Popular., De Alimentis, et De Humoribus,' Cæsaraugustæ (Saragossa), 1567, 4to.; 'Oribasii quæ restant Omnia, Tribus Tomis digesta,' Basil., 1557, 8vo.; 'Georgii Pachymeris Epitome Logicæ Aristotelis,' Paris, 1547, 8vo.; 'G. Pachym. in Univ. Aristot. Disserendi Artem Epitome,' with 'Ammonius in Porphyr. Inst.,' Lugd., 1547, fol.; 'Xenocrates de Alimento ex Aquatilibus,' in Fabricii 'Bibl. Gr.,' tom. ix., pp. 454-474; 'Joannis Grammatici (sive Philoponi), Comment. in primos iv. Aristot. de Naturali Auscult. Libros,' Venet., 1558, fol.

RASIS, or rather **AR-RA'ZI'**, is the patronymic of a celebrated Arabian writer, whose entire name was Ahmed Ibn Mohammed Ibn-Músa. He was denominated Ar-rází because his family was from Ray, a province of Persia. He was born at Cordova, about the middle of the third century of the Hejira (A.D. 864-70). His father Mohammed Ibn-Músa, who was a native of Persia and a wealthy merchant, was in the habit of travelling yearly to Spain with drugs and other produce of the East. Being a man of some learning and ability, he met with great favour and protection from the sultans of the house of Merwan, who then reigned in Cordova, and in one of his visits was prevailed upon to settle in that capital, where he filled offices of trust, being employed in various embassies. He died in the month of Rabi-l-akhar, A.H. 273 (October, A.D. 886). His son Ahmed, when still young, wrote some poems, which he dedicated to Abdu-r-rahman III., sultan of Cordova. He also distinguished himself by his early acquirements in theology and jurisprudence, on which sciences he is said to have left several excellent treatises. But it is in his capacity of royal historiographer that Ar-rází gained most renown. Besides many historical works, the titles of which have not reached us, he wrote a very voluminous history of the conquest of Spain by the Arabs, together with a geographical description of that country, and a few interesting details on its natural productions, industry, commerce, &c. He wrote likewise a history of Mohammedan Spain under the dynasty of the Beni-Umeyyah [MOORS]; and a topographical description of Cordova, the seat of their empire. There is also a genealogical history by him of all the Arabian tribes who settled in Spain at the time of the conquest or soon after it. A portion of the first-mentioned historical work was translated into Spanish, about the end of the thirteenth century, by a converted Moor, named Mohammed, and by Gil Perez, a chaplain to King Dinis of Portugal, by whose orders the version was made. Both Casiri (*Bib. Ar. Hisp. Esc.*, vol. ii., p. 329) and Conde (*Hist. de la Dom.*, vol. i., p. 9) have asserted, without the least foundation, that the 'Historia del Moro Rasis'—for such is the title of the Spanish version—is apocryphal, but there can be no doubt that the work, though containing numerous interpolations, and abounding with blunders, like most translations from Eastern languages made during the middle ages, is an authentic one. Notwithstanding the great importance of the history of Ar-rází, it has never been printed; though manuscript copies are not uncommon. There is one in the library of the British Museum. The year of Ar-rází's death is not known; but as his history falls rather short of the reign of Abdu-r-rahmán, whose historiographer he was, we may safely conclude that he died before A.H. 350 (A.D. 961), the date of that sovereign's death.

RASKOLNIKI. [RUSSIAN CHURCH.]

RASO'RES. The *Rasores* of Illiger contained the following families and genera:—

Gallinacei.—*Numida, Meleagris, Penelope, Crax, Opisthocomus, Pavo, Phasianus, Gallus, Menura, Tetrao*, and *Perdix*.

Epollicati.—*Ortygis* (*Turnix*), *Syrrhaptes*.

Columbini.—*Columba*.

Crypturi.—*Crypturus* (*Tinamus*, Lath.).

Inepti.—*Didus*.

The order, which is the fourth in Illiger's method, is placed between the *Raptatores* and *Cursores*.

The order (v.) *Gallinæ* of Linnæus was placed between the *Grallæ* and the *Passeres*, *Struthio* being the last genus of the former, and *Columba* the first of the latter order.

The genera of *Gallinæ* are *Didus, Pavo, Meleagris, Crax, Phasianus, Numida*, and *Tetrao*.

The *Rasores* of Mr. Vigors consist of the families *Columbidæ, Phasianidæ, Tetraonidæ, Struthionidæ*, and *Cracidæ*.

The *Rasores* of Mr. Swainson comprehend the families *Pavonidæ, Tetraonidæ, Struthionidæ, Columbidæ*, and *Megapodiidæ*.

The *Rasores* of Mr. G. R. Gray embrace the families *Cracidæ, Phasianidæ, Tetraonidæ, Chionidæ*, and *Tinamidæ*.

RASPBERRY. The species from which the varieties of this fruit have been derived is the *Rubus Idæus*, a native of Britain and also of various other parts of Europe. The wide dispersion of the species is easily accounted for from the fact of its seeds resisting the powers of digestion in an eminent degree. Favourable localities would consequently become supplied with seeds by the migration of birds and other subjects of the animal kingdom. Seeds of a raspberry found in the body of a person who had been interred in Dorsetshire in the time of Hadrian, were sown and vegetated some years since. On its fruiting, it proved very similar to the red raspberry commonly met with in woods at the present day; and from this type, it may be observed, the most improved varieties are not by any means so far removed, with regard both to size and flavour, as are the generality of cultivated fruits from their original species.

For a selection, the following varieties may be enumerated:—Red Antwerp, Yellow Antwerp, Barnet, Bromley Hill, Cornish, Superb, Woodward's Red Globe, and Double Bearing.

The best soil for raspberries is a light rich loam. They will thrive well in sandy peat, provided it is not too dry. In all cases the ground for a plantation should be well trenched and manured previous to planting. The plants from suckers, of which there are generally abundance, should be planted in rows four or five feet apart, and three feet from plant to plant in the row. When planted they should be cut to within six inches of the ground; for although this is not absolutely essential, yet by so doing the shoots for the following season are greatly strengthened.

Pruning should be performed in autumn. It consists in first clearing off all dead portions, and retaining only a few of the strongest summer shoots of each plant, which should be shortened according to their strength, generally at a bend, which indicates where the shoot becomes weak, near the extremity. In the following summer the shoots just mentioned bear the fruit, whilst others spring up at their base for a succession; and in all cases succession shoots should be disposed so as neither to crowd the fruiting portion nor each other.

The ground of a raspberry plantation should be kept loose and supplied with well-rotted manure, but in so doing a fork should be used in preference to a spade, in order to preserve the roots as much as possible, and the roots should not be at all disturbed after active vegetation takes place in spring. Notwithstanding the best management in these respects, it becomes adviseable to make a new plantation in fresh soil after four or five years; for the roots diffuse themselves so thoroughly in every portion of the soil near the stools, that it soon becomes exhausted.

The fruit of the raspberry is extensively used in a variety of ways, both by the cook and the confectioner, and also in the preparation of cordial spirituous liquors.

RASTADT is a town with a population of 5680 inhabitants, in the grand-duchy of Baden, on the river Murg, not far from the Rhine. It is regularly built. Among the public buildings is the Favorita, a fine palace, built on the model of that of Versailles, and till 1771 the residence of the margrave of Baden. There are three churches, the principal of which is reckoned very handsome; two chapels; a lyceum; and a Roman Catholic seminary for the education of schoolmasters. The manufactories of starch, succory (as a substitute for coffee), snuff, and tobacco are flourishing. A manufactory of papier-mâché produces very handsome articles, which are highly esteemed. The other manufactures are fire-arms, mathematical and philosophical instruments, and carriages. Rastadt has been the scene of important negotiations. In 1713, Prince Eugene and Marshal Villars commenced the negotiations which terminated the war of the Spanish succession by the peace of Rastadt, on the 6th of March, 1714. The German empire not being included in this peace, a separate treaty was concluded by Eugene and Villars on the 7th of September, 1714, which terminated the war between France and the empire.

On the 9th of December, 1797, a congress was assembled at Rastadt, under the mediation of Prussia and Austria, to negotiate a peace between France and the German empire, which was dissolved by the emperor on the 7th of April, 1799. The French ambassadors, Roberjeot, Bonnier, and Jean Debry, after the interruption of the negotiation, left Rastadt, on the 28th of April, at nine in the evening, provided with passports from Baron Albini, envoy of the elector of Mayence; but they were attacked, about five hundred paces from the suburb, by a troop of hussars of the regiment Barbaczi. Roberjeot and Bonnier were killed. Jean Debry, though wounded, and the secretary Rosenstiel, escaped to Rastadt, and were escorted to the frontier by Szekler hussars. Notwithstanding the strict investigation ordered by the Diet at Ratisbon, and conducted by the archduke Charles, no satisfactory evidence was obtained respecting the authors of this crime.

RASTALL, or RASTELL, JOHN, one of our early printers, is said by Bale to have been a citizen of London, and by Pits a native of that city. Wood says he was educated in grammar and philosophy at Oxford, and returning to London, set up the trade of printing. The first work which bears his name as printer, with a date, was published in 1517, the last in 1533. There are numerous others without dates. His residence was at the sign of the Mermaid, at Paul's Gate next Cheapside. He married Elizabeth, sister to Sir Thomas More, with whom Herbert supposes he became intimate in consequence of being employed to print Sir Thomas's 'Dyalogue' on the worship of Images and

Reliques, published in 1529; but, as will hereafter be seen, his eldest son was born in 1508.

Bale and Pits ascribe the authorship of various works to John Rastall; the most remarkable of which is his 'Anglorum Regum Chronicon, or Pastyme of People,' a work of extreme rarity, reprinted in 1811 in the 'Collection of English Chronicles.' He translated from French into English the Abridgement of the Statutes before the reign of Henry VII., and also abridged those of that reign which were made in English, as likewise those of Henry VIII., including the twenty-third and twenty-fourth of his reign. He also compiled several law-books. Of these, his 'Exposition of Law Terms and the Nature of Writs,' and the book called 'Rastall's Entries,' continued long in use.

Wood says that Rastall, by frequent conferences with Sir Thomas More, improved his knowledge in various sorts of learning, which is probable; but he omits to notice, what is more important, that Rastall became a convert to the reformed religion by means of a controversy with John Frith. Rastall published 'Three Dialogues,' the last of which treats of purgatory, and was answered by Frith. On this, Rastall wrote his 'Apology against John Frith,' which the latter answered with such strength of argument as to make a convert of his opponent. Rastall also wrote a book called 'The Church of John Rastall,' which, being in the list of prohibited books published by Bishop Bonner, annexed to his injunctions in 1542, is supposed to have contained some retractation of his former opinions, at least of what he had written concerning purgatory.

He died at London, in 1536, leaving two sons, William and John; the latter afterwards a justice of the peace. The notice of the former immediately follows.

RASTALL, WILLIAM, was born in London, in 1508, and about 1525 was sent to Oxford, which he left without taking a degree, and entered at Lincoln's Inn for the study of law. In the first of Edward VI. he became autumn or summer reader of Lincoln's Inn; but on the change of religion, he retired with his wife to Louvain, whence he returned on the accession of Queen Mary. In 1554 he was made a serjeant-at-law, one of the commissioners for the prosecution of heretics, and, a little before Mary's death, one of the justices of the Common Pleas. Queen Elizabeth renewed his patent as justice, but he preferred retiring to Louvain, where he died, August 27, 1565. His wife, who died in 1553, on their first going to Louvain, at the age of twenty-six, was the daughter of Dr. John Clement, one of the physicians sent by Henry VIII. to Cardinal Wolsey during his last illness.

From 1530 to 1534 (Dibdin, in his edition of Herbert's 'Ames,' thinks till 1554), William Rastall carried on the business of a printer, in conjunction with his practice as a lawyer. When Justice Rastall, he published 'A Collection (abridged) of the Statutes in Force and Use,' in 1557, often reprinted.

(Wood's *Athen. Oxon.*, edit. Bliss, vol. i., col. 100; Dibdin's edit. of Herbert's *Typogr. Antiq.*, vol. iii., pp. 81-110, 370-383; Chalmers's *Biogr. Dict.*, vol. xxvi., p. 51-54.)

RAT. [Muridæ, vol. xv., p. 506.] Few animals are more destructive of every kind of grain than rats. When a barn is infested with them, it is scarcely possible to get rid of them. They will leave it for a time, and the farmer imagines that they are all destroyed; but no sooner is the corn brought in than they resume their depredations. There are means however of destroying them, and some of these means are equally effectual and ingenious. The most obvious way of destroying rats is to poison them, which appears an easy matter; but it is not so without an accurate knowledge of the habits of these creatures. Their sense of smelling is more acute than we can well conceive, and their caution is not easily deceived. It is difficult to entice them with food when they have plenty of grain to satisfy their hunger. Patience and perseverance alone can lull their caution to rest.

The principle on which all rat-catchers proceed is to entice the rats to some particular spot, convenient for their future operations. There are some strong scents which these animals seem to delight in; and, by means of these, their natural sagacity is deceived. Oil of rhodium, of carraway, or aniseed, and musk, are great favourites with rats. Rags, impregnated with these, and which have not been in contact with any part of the body of a man, being laid, as if by accident, will induce them to come out of their hiding-places in the night, and frequent the spot where the smell attracts them. Gradually they will become familiarised with the place; and pieces of tallow or cheese or malt-dust may be placed near without exciting their suspicion. After they have been fed for a time, they will readily eat anything that may be thrown down, provided it has not been touched by the hand without the covering of a glove properly scented. It will take some time to accomplish this; and when they are to be poisoned, a quantity of poisoned food, similar to what they have been accustomed to feed on, must be prepared, sufficient to poison all those which are supposed to frequent the place. The poisons commonly used are arsenic, nux vomica, powdered Spanish flies, and cocculus indicus, which intoxicates them, so that they may be taken by the hand. A small chamber, or a large chest or box, is convenient to collect the rats; and in order to induce them to go in, pieces of toasted cheese or red-herring are trailed along the ground from the rat-holes to the place where it is wished that they should assemble. As soon as they have been accustomed to find food which they like, they will all come to it in the night; and they can be poisoned, or caught by some contrivance by which the only entrance to the place or box can be suddenly closed. When traps are set, they should be left open for a time, and the rats allowed to go in and out without hindrance, till they crowd together in them, and can be taken in great numbers. When rats have been caught in a trap, and have soiled it with their excrements, it should not be washed, nor much handled: it should be left in the same spot, as long as any rats are caught. Any change of position excites their caution. An ingenious trap is made by stretching a piece of parchment over the open end of a cask, and enticing the rats to eat the food laid upon the parchment. When they have evidently been there to feed, cross cuts, a few inches long, are made in the parchment with a penknife; and in the bottom of the tub, which has four inches of water in it, a brick is set on its edge, so as just to rise out of the water. The rats coming for food, as usual, some one soon slips through the parchment, and, falling into the water, seeks refuge on the brick: as more fall in, they fight for the possession of the brick, and their noise attracts all the rats within hearing. Thus it is said that a great number may be caught in one night. In the 'Cyclopædia of Agriculture,' by Loudon, there is a description of a very complicated trap for rats, which appears very ingenious; but whether it is effective we have not had an opportunity of proving.

RATANY, RHATANY, or RATANHI'A, is the Krameria triandra of botanists; a half-shrubby plant found on the dry gravelly soil of Peru, whose root is excessively astringent, and is exported to Europe on that account. The stem lies prostrate, is two or three feet long, and covered with silky hairs. It has oblong, sharp-pointed, undivided, hoary leaves, and solitary, dull brown flowers, succeeded by a bur-like fruit. The extract of this root is a powerful styptic and tonic. The bark is turned black by iodine, and contains much tannin. It is used medicinally in this country as an astringent medicine in passive bloody or mucous discharges, weakness of the digestive organs, and even in putrid fevers. Its powder, mixed with charcoal, forms excellent tooth-powder.

RATA'RIA. [Cirrhigrada, vol. vii., p. 201.]

RATE, an assessment levied upon property. Rates are of various kinds, and are denominated with reference to the objects to which they are applied.

Church-rates are payable by the parishioners and occupiers of the land within a parish, for the purpose of repairing, maintaining, and restoring the body of the church and the belfry, the churchyard fence, the bells, seats, and ornaments, and of defraying the expenses attending the service of the church. The spire or tower is considered part of the church. The duty of repairing and rebuilding the chancel devolves on the rector, or vicar, or both together, in proportion to their benefice, where there are both in the same church. But by custom the parishioners may be liable to repair the chancel; and in London there is a general custom to that effect. Church-rate exists in England by virtue of the common law; nothing is known as to its commencement or introduction. In the early period of the church there appears to have been a division of the tithes,—either tripartite, one portion to the clergy, one to repairs of the church, and one to the poor; or quadripartite, one to the bishop, the other three to the clergy, the church, and the poor. That period was before the existence of parishes, when the only ecclesiastical division was the episcopal district or diocese, then called parochia. At that time the bishop resided at the cathedral church, together with his clergy, and on him devolved the duty of repairing the church, caring for the poor, and supplying ecclesiastical ministry. It was then the duty of every Christian man to pay to the bishop not only the decimæ, or tithes, but also the ecclesiæ census, church-scot, and the nummus eleemosynarius (alms money). The object to which church-scot was devoted is not known. It was also the duty of the bishop to admonish even the king that the temples of God be properly furnished; so that some other contribution seems to have been expected from the laity. There is no symptom that any alteration of usage occurred when the local endowment of churches was introduced. Church-rates, or something equivalent, certainly appear to have been in existence as a payment by the laity, independent of tithes, in the time of Canute, whose 63rd law, 'de fano reficiendo,' states that all persons ought of right to contribute to the repair of churches.

Church-rates are imposed by the parishioners themselves, at a meeting summoned by the churchwardens for that purpose. Upon the churchwardens, conjointly with the minister, devolves the care of the fabric of the church and the due administration of its offices. With a view to provide a fund for such expenses, it is the duty of the churchwardens to summon parish-meetings for the purpose of levying rates; and if they neglect to do so, they may be proceeded against both civilly and criminally in the ecclesiastical courts. A mandamus also is grantable to compel such meeting to be held. If the parish fail to meet, the churchwardens may themselves impose a rate. But if the meeting should assemble, it rests with the parishioners themselves to determine the amount of the rate; and they also, it would seem, have authority to negative the imposition of a rate altogether.* The only mode of compelling the parishioners to impose one is by ecclesiastical censures and laying the parish under interdict. The existing poor-rate of the parish is generally taken as the criterion for the imposition of the church-rate. All property in the parish is liable except the glebe-land of that parish and the possessions of the crown. Stock in trade is not generally rated, but a custom may exist rendering it rateable in a particular parish. The ecclesiastical courts have the exclusive authority of deciding on the validity of a rate, and the liability of a party to pay it; but a ratepayer cannot by an original proceeding in those courts raise objections to a rate for the purpose of quashing it altogether. If he wishes to dispute it, he ought to attend at the vestry, and there state his objections; if they are not removed, he may enter a caveat against the confirmation of the rate, or refuse to pay his assessment. In the latter case, if proceeded against in the ecclesiastical court, he may in his defence show either that the rate is generally invalid, or that he is unfairly assessed. The consequence of entering a caveat is an appeal to the ecclesiastical judge, who will see that right is done. There appears some reason to doubt whether the grounds on which a poor-rate is held to be bad because retrospective, are on principle applicable to a church-rate. The ecclesiastical courts have however decided that a retrospective church-rate is bad. Previously to 53 Geo. III., c. 127, the only mode of recovering church-rates from parties refusing to pay was by suit in the ecclesiastical court for subtraction of rate. By that statute, where the sum to be recovered is under 10*l.*, and there is no question as to the validity of the rate, or the liability of the party assessed, any justice of the county where the church is situated may, on complaint of the churchwarden, inquire into the merits of the case, and order the payment. Against his decision there is an appeal to the quarter-sessions. By several statutes, principally the 58 Geo. III., c. 45, and 59 Geo. III., c. 134, acts passed for the promotion of building churches, the common-law powers of churchwardens have been varied, and extended so as to enable them to raise money on the security of church rates, and to apply them for the enlargement, improvement, &c. of churches, and for the building of new ones, &c. &c. As to other rates, see SEWERS, SHIRE, WAY.

(Lyndwood; John de Athon; Selden's *History of Tithes*; Gibson's *Codex*; Burn's *Ecclesiastical Law*; Rogers's *Ecclesiastical Law*, 1840.)

RATEL. [URSIDÆ.]

RATHKEALE. [LIMERICK.]

RATIO. One of the most frequent mathematical terms has no other name in our language than a Latin word which is but a bad translation from the Greek of Euclid. The older English writers introduced the word *reason*, as a translation of ratio, which completed the confusion; for it is easier to attach any meaning we please to a word in a dead language than to the literal translation of it in our own.

The word ratio is the translation of λόγος, as used in the third definition of the fifth book of Euclid, which is Λόγος ἐστὶ δύο μεγεθῶν ὁμογενῶν ἡ κατὰ πηλικότητα πρὸς ἄλληλα ποιὰ σχέσις. This has been translated as follows:—By Athelard (in what is called Campanus's translation from the Arabic), 'Proportio est duarum quantecunque sint ejusdem generis quantitatum certa alterius ad alterium habitudo.' By Billingsley, in the earliest English translation 'Reason is an habitude of two magnitudes of the same kind, compared the one to the other, according to quantity.' By various later English writers, 'Ratio is a mutual habitude of two magnitudes of the same kind with respect to quantity.' By Gregory, in his translation which accompanies the Greek, 'Ratio est duarum magnitudinum ejusdem generis secundum quantuplicitatem mutua quædam habitudo.'

The common translation partakes more of the confusion of the Arabic than of the clearness of the Greek; and it will be worth while to offer some remarks on the probable meaning of Euclid. In the first place, let it be observed that he never attempts this vague sort of definition except when, dealing with a well-known term of common life, he wishes to bring it into geometry with something like an expressed meaning, which may aid the conception of the thing, even though it does not furnish a perfect criterion. Thus, when in speaking of a straight line, he says that it is the line which lies evenly (ἐξίσου κεῖται) between its extreme points, he merely calls the reader's attention to the well known term εὐθεῖα γραμμή, tries how far he can present the conception which accompanies it in other words, and trusts for the correct use of the term in the axioms which the universal conception of a straight line makes self evident. Let us suppose him doing the same thing here, and we shall find that the definition before us, considered with reference to the place it is in, and the subsequent purpose which it serves, is as clear as the translation of it is confused.

The term λόγος contains (λεγ, λογ), a root the original meaning of which seems to have contained the idea of collection or bringing together. It is certain however that the secondary sense which it obtained in common usage was that of speaking; so that the first sense in which λόγος appears in writings is that of speech. Subsequently, speech being the distinctive character of reasoning beings, and their mode of communication, the word was applied to every sort of communication, not only with reference to the mode of communication, but also to its subject; thus explanation, defence, apology, teaching, assignment of cause or reason, &c., are among the recognised uses of the word. The Latin translators have taken the geometrical word as being properly translated by *ratio*, a word which may very well signify the technical meaning of λόγος, but has no reference to its primary meaning. For ratio, in its primitive sense, means rather computation or reckoning than reason.

But what has speech to do with the sense of ratio in geometry? Robert Recorde answers this question (NUMERATION, vol. xvi., p. 367) when he reduces his pupil to silence by forbidding him the use of number, and asking him questions. Numbers are but certain ratios, and ratio is a generalised idea of number. Our gift of speech with reference to magnitudes would be altogether annihilated if we did not consider a certain habitude or mode of existence which they have, or more correctly a certain conception of our own, which always accompanies the presence of two magnitudes, which prompts us to inquire how many times one is contained in the other. A foot being known, speech can carry a correct knowledge of other lengths all over the world; but let it be attempted to describe a foot in words without reference κατὰ πηλικότητα to some other magnitude, and all the powers of language utterly fail. We conceive then that in this definition Euclid simply conveys the fact that the mode of expressing quantity in terms of quantity is entirely based upon the notion of *quantuplicity* or that relation of which we take cognizance when we find how many times one is contained in the other.

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* In Burder v. Veley, the question was raised whether the churchwardens had power to impose a rate after the parishioners in vestry assembled had negatived the imposition. The Court of Queen's Bench, after hearing elaborate arguments, and taking time to consider, determined that they had no such power. The case has since been argued in error, and the court have not yet pronounced their decision.

The word πηλικότης has been translated 'quantity,' by many editors, which makes nonsense of the whole; for magnitude has hardly a different meaning from quantity, and a relation of magnitudes with respect to quantity may [illegible] to convey a no[illegible] [illegible] building, or of battles [illegible] respect [illegible] others. Wallis, we believe, restored the true meaning of the word, and was followed by Gregory, as seen above; and Euclid himself, in another place, shows in what sense he used it. In the fifth definition of the sixth book (omitted by many editors), he says that a ratio is compounded of two other ratios when the πηλικότητες of the latter *multiplied* (πολλαπλασιασθεῖσαι) together, make the former. Now, this would be unmeaning if the Greek word meant simply quantities, unless they were quantities represented by numbers (though Gregory has here forgotten his own previous correction, and writes quantitas instead of quantuplicitas). The lexicographers generally give 'quantitas;' but they are not for the most part adepts in the mathematical use of terms implying relations of magnitude.

The first and rough notion of ratio being thus given, we may find a synonyme for the word in the more intelligible term *relative magnitude*. Six feet, though greater than three feet, is, relatively to four feet, a less magnitude than three feet is, relatively to one foot: the number of times which six feet contains four feet is less than the number o times which three feet contains one foot. The relative magnitude of six to four is less than the relative magnitude of three to one; or the ratio of six to four is less than the ratio of three to one.

Given two magnitudes, how are we to find the means of expressing the first in terms of the second? Euclid answers this question, when it can be answered, in the tenth book by giving the rule for finding the greatest common measure of two magnitudes, in which he employs a process exactly the same as that of the arithmetical rule in common use. Let A and B be two magnitudes (say lines), of which B is the less. From A cut off a part equal to B, do th same again, and so on, until R_1, the part left, is less than B Say it is found that A contains 5 times B and R_1. Measure R_1 upon B in the same way, and suppose B contains times R_1 and R_2. Suppose now that R_1 contains 6 R_2 and R_3, and also that R_2 contains exactly 7 times R_3. We have then

$$R_2=7R_3,\ \ R_1=6R_2+R_3=43R_3$$
$$B=4R_1+R_2=172R_3+7R_3=179R_3$$
$$A=5B+R_1=895R_3+43R_3=938R_3.$$

We have then the same means of expressing A in terms of B that we have of expressing 938 in terms of 179: or we should give the power of deducing either when the other is known, by saying that the 179th part of the first is the same magnitude as the 938th part of the second.

But it may happen that the magnitudes have no common measure [INCOMMENSURABLE], in which case the preceding process would never have an end, and the means of expression would fail. We can describe the diagonal of a square as a part of a certain figure, and the description is perfect; but if we attempted a description *secundum quantuplicitatem*, we should never succeed; for no possible line exists of which it can be said that the diagonal of a square and its side both contain that line exactly. Such quantities are called by Euclid ἄλογοι, irrational, or having no ratio; and in the primitive meaning of the term this is correct, for there is no quantuplicitative mode of expressing one by the other. But the term ratio, both in Euclid and all other writers, immediately acquires another sense; and it is this new sense in which we proceed to speak of ratio. Since the relative magnitude of two quantities is always shown by the quantuplicitative mode of expression, when that is possible, and since proportional quantities (pairs which have the same relative magnitude) are pairs which have the same mode (if possible) of expression by means of each other; in all such cases sameness of relative magnitude leads to sameness of mode of expression; or proportion is sameness of ratios (in the primitive sense). But sameness of relative magnitude may exist where quantuplicitative expression is impossible; thus the diagonal of a larger square is the same compared with its side as the diagonal of a smaller square compared with *its* side. It is an easy transition to speak of sameness of ratio even in this case; that is, to use the term ratio in the sense of relative magnitude, that word having originally only a reference to the mode of expressing relative magnitude, in cases which allow of a particular mode of expression. The word irrational does not make any corresponding change, but continues to have its primitive meaning, namely, incapable of quantuplicitative expression. And it is worth noting that this of itself shows that the original meaning of λόγος referred to expression, not to the thing expressed; for ἄλογον (not having a ratio) would have been absurd as applied to incommensurable quantities, if the primitive mathematical meaning of the first word had coincided with its modern one.

The idea of relative magnitude is one which strikes us in all cases in which we compare the parts of an original with the corresponding parts of any model or imitation. It does not closely connect itself with any mode of expression or measurement: if a part of the model were only in a slight degree too large or too small, the detection of the error might require a formal measurement, but anything which is very much out would be rejected by one glance of the eye. Let us suppose now that the formal measurement is attempted. The first and simplest notions of relative magnitude are gained from repetition; and the ideas of two, three, four, &c., originally used in their simple cumulative sense, soon become the representatives of those simple relative magnitudes which are suggested by pairs in which one is quantuple of the other. The next step is to those magnitudes in which neither is quantuple of the other, but both are quantuple of a third: from which we learn how, admitting aliquot parts, to extend the mode of expression. Thus, of the magnitudes 10 R and 7 R, we see that every relation of quantuplicity can be derived from the simple numbers 10 and 7: the first number is $1\frac{3}{7}$ of the second, a mode of expression which equally applies to the magnitudes 10 R and 7 R. The preceding would be unnecessarily laborious if it were not as an introduction to the remaining and most frequently occurring case of quantities, the relative magnitude of which cannot be expressed by that of number to number; or incommensurable magnitudes.

Let D and S be two incommensurable magnitudes: how are we to describe their relative magnitudes? That they have a definite relation is certain; suppose, for precision, that S is the side of a square, and D its diagonal; any alteration of D, or any error in D, S being given, would make the figure cease to be a square. There are many mathematical notions in which accuracy is not attainable in finite terms, but is the limit towards which we approach when number or magnitude, as the case may be, is increased or diminished without limit. In the present case the expression of ratio or relative magnitude, which is not accurately attainable by one or more relations, can be continually amended by adding one or more relations, until the inaccuracy of the mode of expression is rendered as small as we please: in such a case, accuracy must be imagined to reside in the supposition of an infinite number of given, or at least of attainable, relations.

To explain our meaning, suppose that the person whom we address is altogether ignorant of the relative magnitude of the diagonal D and the side S. He asks for a relation, and knowing the mode of dealing with the ratios of commensurables, naturally desires to know how many diagonals make an exact number of sides. If we could answer this question, if for instance we could say that 100 diagonals make 142 sides exactly, the question would be settled: for an arithmetical rule would always deduce the diagonal when the side is given. But we are obliged to reply, that no number of diagonals whatsoever will make an exact number of sides. He then asks how he is to form a perfect conception of the diagonal; we answer by placing two equal sides at right angles to one another, and joining the extremities. This, he replies, and properly, is not a mode of finding the relative magnitude, which is something connected with magnitudes only, and that the permission given by Euclid to join two given or determined points is not any real determination of the included length. We then tell him that it is at his pleasure to name a fraction of the side, and we can express the diagonal with an error not so great as that fraction; he names, say one-millionth of the side, and we give him the promised information in telling him that 1,000,000 of diagonals exceed 1,414,213 sides, but fall short of 1,414.214 sides. The consequence is, that the diagonal lies between 1·414213 and 1·414214 of the side; these differ from one another by one-millionth of the side, and the error of the diagonal is of course less. If he should ask how he is to carry this process yet further for himself, we give him the arithmetical symbol $\sqrt{2}$, and instruct him how to perform the arithmetical operation of approximating to its value. In this we show him how to find, between what number of sides any number of diagonals lies; and in so doing we give the ratio of the diagonal to the side as far as the nature of the case will admit of.

The relative magnitude, then, of two magnitudes is given, when the place of any multiple whatsoever of the one among the multiples of the other can be found from the data. For example, we carry on the *multiple scale* of the side and diagonal of a square, in the power of extending which ad infinitum lies that of expressing the ratio, so far as expression is possible, and of absolutely comparing the ratio with others, in as accurate a manner as if expression had been perfect.

S, D, 2S, 2D, 3S, 4S, 3D, 5S, 4D, 6S, 7S, 5D, 8S, 6D, 9S, 7D, 10S, 11S, 8D, 12S, 9D, 13S, 14S, 10D, 15S, 11D, 16S, 12D, 17S, 18S, 13D, 19S, 14D, 20S, 21S, 15D, &c.

In this table we see, for instance, that 10 diagonals are more than 14 and less than 15 sides, and so on. The only doubt that can possibly remain may be thus expressed:—Is the preceding scale a property of the diagonal and of nothing else? May there not be a length so near to the diagonal that its multiples shall never fall out of the same intervals as those of the diagonal? Let K be a given quantity, no matter how small; we say that it is impossible that all the multiples of D+K can lie in the same places among the multiples of S as the multiples of D. Take m times both; then $m(D+K)$ and mD differ by mK. Now however small K may be, it is possible to take m so great that mK shall exceed S, or any multiple of S previously named: whence the thing asserted is evident. The definition of the ratio of S to D lies, then, in this scale; or rather, whatever the definition may be, the mode of finding all relations between S and D lies in the formation of this scale, so far as may be necessary for the purpose in hand. The definition of proportion is then contained in sameness of multiple scales; that is, D is to S as A to B, when any multiple whatever of D is contained between the same two multiples of S, that the same multiple of A is contained between of B. We here come to the subject of PROPORTION, which the reader should now consult as a continuation of the present one.

The next step to be made is rather an abstract one: ratio itself is a magnitude, that is, the relative magnitude of one magnitude to another is itself a magnitude. To understand this, remember that by magnitude we do not mean merely physical magnitude, as size, weight, length, &c., but any conception of our minds as to which it is evident that either greater, equal, or less, must be a term applicable to every two such conceptions, and that a mode of measuring excess or defect, as also of ascertaining equality, can be found. This is easily done as follows, with which the considerations connected with greater and less ratio in the article PROPORTION may be read:—Which is the greater ratio, that of P to Q, or of A to B? that is, which magnitude is relatively greater, P as compared with Q, or A as compared with B? Chose any quantity, Z, and let the ratio of A to B be that of X to Z, while that of P to Q is that of Y to Z. The question is then reduced to the following: which is greatest, X considered relatively to Z, or Y relatively to the same Z? The answer obviously depends upon which is absolutely the greater of the two, X or Y. Let X be the greater, then the ratio of A to B is greater than that of P to Q. But in what relation is the ratio of A to B greater than that of P to Q? Repeat the transformation, and the ratio of X to Z is greater than the ratio of Y to Z, in exactly the same manner as X is greater than Y: that is, the ratio of X to Y is the ratio of the ratio of A to B to that of P to Q. To find the ratio of two ratios then, namely, A to B, and P to Q, let

$$A : B :: X : Z$$
$$Q : P :: Z : Y$$

and the ratio of X to Y is the ratio of ratios required. This process is called by Euclid the composition of the ratios of A to B and of Q to P; that is, he would say that the ratio of the ratios of A to B and of P to Q is the ratio compounded of the ratios of A to B and of Q to P. Later writers called this process of composition by the name of addition*; though it may easily be made to appear that where one of the ratios is that of number to number, composition is multiplication of the corresponding terms. Thus, to compound the ratio of the diagonal D and the side S with that of 7 to 3, we have

$$D : S :: 3D : 3S$$
$$7 : 3 :: 7D : 3D$$

whence the ratio of 7D to 3S is the compounded ratio. This term of addition was an anticipation, to a small extent, of the principle of logarithms. Thus, if

$$A : B :: V : W$$
$$A : B :: W : X$$
$$A : B :: X : Y$$

the ratio of V : Y, compounded of the ratios of A to B, A to B, and A to B, was said to contain the ratio of A to B three times. Thus if any given ratio (as A to B) were taken as a measure, all other ratios might be measured by it, either exactly or approximately. Thus, if the ratio of V to Z were required to be measured by the ratio of A to B, there would be taken $V : V_1$, $V_1 : V_2$, $V_2 : V_3$, &c., all the same ratios as A : B; if V_n be the last of these which is less than Z, and V_{n+1} the first which is greater, it would be said that the ratio of V to Z contains that of A to B more than n times and less than $n+1$ times. Hence arise the use of the duplicate (or double) ratio, as being the ratio compounded of that of A to B with itself; of triplicate (a triple ratio) as that compounded of the ratio of A to B, A to B, and A to B, and so on. The following summary shows both the old and modern algebraical use of these terms, the capital letters representing magnitudes, the small letters numbers.

Duplicate ratio of A to B. The ratio compounded of those of A to B, and A to B. Do. of a to b is that of a^2 to b^2.

Triplicate ratio of A to B. The ratio compounded of the duplicate ratio of A to B, and of A to B. Do. of a to b is that of a^3 to b^3. And so on.

Subduplicate ratio of A to B. The ratio whose duplicate ratio is that of A to B. Do. of a to b is that of $\sqrt{a}$ to $\sqrt{b}$.

Subtriplicate ratio of A to B. The ratio whose triplicate ratio is that of A to B. Do. of a to b is that of $\sqrt[3]{a} : \sqrt[3]{b}$. And so on.

Sesquiplicate ratio of A to B. The ratio compounded of that of A to B and its subduplicate. Do. of a to b is that of $\sqrt{a^3}$ to $\sqrt{b^3}$.

We have not spent any space in drawing the analogies, which are very close, between the doctrine of fractions and that of ratios. The reader who understands what we have here said, will easily supply this part for himself, remembering that when A and B are numerical, the fraction A÷B is the expression of the ratio of A to B. Modern writers employ fractions instead of ratios, and with great advantage. But the student who leaves untouched that consideration of ratio which includes incommensurables as well as commensurables will never be more than a mathematician to a certain number of decimal places.

The older writers on geometry, and even algebra, are frequently unintelligible to a reader who is not versed in the language of ratios as used by the Greeks and augmented by the inquirers of the middle ages. Many a young reader has met for the first time with what purported to be an explanation of logarithms in Halley's celebrated paper, which was prefixed to Sherwin's 'Logarithms,' and, we believe, to others. The following is a sample:—

'But first it may be requisite to premise a definition of logarithms, in order to render the ensuing discourse more clear, the rather because the old one, *numerorum proportionalium æqui-differentes comites*, seems too scanty to define them fully. They may more properly be said to be *numeri rationum exponentes*, wherein we consider *ratio* as a *quantitas sui generis*, beginning from the *ratio* of *equality*, or 1 to 1=0; being affirmative when the *ratio* is increasing, as of unity to a greater number, but negative when decreasing; and these *rationes* we suppose to be measured by the number of *ratiunculæ* contained in each. Now these *ratiunculæ* are so to be understood as in a continued scale of proportionals infinite in number between the two terms of the *ratio*, which infinite number of mean proportionals is to that infinite number of the like and equal *ratiunculæ* between any other two terms, as the logarithm of the one ratio is to the logarithm of the other. Thus if there be supposed between 1 and 10 an infinite scale of mean proportionals whose number is 100,000, &c. *in infinitum*, between 1 and 2 there shall be 30,102, &c. of such proportionals, and between 1 and 3 there will be 47,712, &c. of them; which numbers therefore are the logarithms of the

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* Euclid's words for compounding (*συγκεῖσθαι* and *συντίθεσθαι*) both imply addition.

rationes of 1 to 10, 1 to 2, and 1 to 3; and not so properly to be called the logarithms of 10, 2, and 3.

The way in which the preceding would be put in our day is given in Logarithms, p. 65. We leave it to the reader to satisfy himself that what is there said is a translation of the preceding into modern [illegible]

For any one who would wish to see the manner in which the notion of ratio was formerly treated, we should recommend Meibomius 'De Proportionibus Dialogus,' Copen- [illegible] 1655, for the sake of the answer by Wallis, which is [illegible] collection of his works (vol. i., p. 229), and was previously published in his 'Operum Mathem. pars prima,' [illegible] 1657.

[illegible]ONAL. A quantity, algebraic or arithmetical, is rational when it can be expressed without the use of the [illegible] of evolution, such as those of the square root, cube [illegible] &c. [Irrational.]

RATIONALISM is a system of theology, which, as a system, began to be developed in Germany during the latter half of the last century. To understand the origin and character of this school of theology it will be necessary to take a glance at the state of theology previous to the appearance of Rationalism.

During the first half of the last century theology in Germany was what it had been during the seventeenth century; its literature was little more than a series of controversial writings, in which the disputed points were often discussed in a coarse and uninstructive manner, and most of the topics themselves were altogether unimportant. At the same time men of acknowledged talents in England and France abandoned Christianity altogether, and endeavoured by their writings to undermine its foundations. We allude to the numerous English deists, and to the school of Voltaire and his followers. These writers not only denied the historical authenticity of the biblical records, but declared them to be fabrications. Reimarus of Hamburg was the first German who adopted these and similar views, and he introduced them among his countrymen in a work called 'Die vornehmsten Wahrheiten der natürlichen Religion,' Hamb., 1754. Another still more important work by Reimarus consisted of several essays on various points in the New Testament. These essays were not printed, but distributed, in MS., among his most intimate friends. When Lessing was librarian at Wolfenbüttel, he obtained a copy of these essays, and, in 1773, began publishing them, under the title of 'Fragmente eines Ungenannten,' pretending that he had found them in MS. in the Wolfenbüttel library, whence they are generally called 'Die Wolfenbüttelschen Fragmente.' In these fragments, or essays, an attempt was made not only to show the improbability and impossibility of a revealed religion in general, but more especially to prove that the books of the Old and New Testaments were not of divine origin, and that the plan which Jesus endeavoured to realise was of a political nature. This scheme, it was further alleged, was thwarted by his execution, and his disciples, discouraged by this blow, are represented as having propagated a report of the resurrection of their master, and as having disguised their real object by cunningly introducing some modifications into their system. The publication of these fragments created an extraordinary sensation in Germany, and roused the theologians from their inactivity. The majority however remained faithful to their belief in the scriptures; but another class of German divines, though opposed to the views of the fragmentist and the deists, struck out a middle path. These were the Rationalists, who indeed went half way with their adversaries, in as far as they denied the divine origin of the scriptures, but they dissented from the deists, who affirmed that the Bible was the product of fraud, and they maintained that, notwithstanding all the apparent incongruities of the Bible, it was based on genuine historical foundations, to ascertain which was the problem of reason. The authors of the biblical books, according to the Rationalists, were not impostors, but men of moral purity, who, being deluded by the excited state of their imagination, considered things to be miraculous which were only natural occurrences. Other portions of the Bible, they said, which have hitherto been considered as recording supernatural events, need only to be divested of the figurative and allegorical mode of expression so peculiar to all Eastern nations, in order to appear as the records of ordinary occurrences. This mode of interpretation was the more readily adopted by a great number of theologians, as it had been and was then still applied to the fabulous stories of heathen antiquity. Attempts had been made to elicit real history from mythical traditions, by stripping them of their poetical embellishments and marvellous ingredients. But the skeleton which remained after such a process was generally imperfect and disjointed, and it could only be completed by supplying secondary and additional circumstances, which were [illegible] necessary to make up something like a connected history, and which the writer himself was supposed to have overlooked or neglected, though the narrative did not contain any thing to justify such a supposition, and in many cases was even directly opposed to it. The history thus constructed out of the interpreter's imagination was offered [illegible] discovered truth, and this mode [illegible] in reality the most irrational, was called the rational method of interpreting the scriptures. To account for the way in which the supposed collateral circumstances and the minute details in the accounts of so many miracles arose, merely out of the psychological state of the beholder or reporter, would in most instances suggest to the mind of the reader of these rationalistic interpretations a greater miracle than that which they endeavour to explain away. This method moreover leaves such a wide field of speculation, that twenty expounders, each taking his own view of a case, and translating the supposed allegorical expressions into his own language, might possibly produce twenty different stories, all of which might with equal plausibility be elicited from the original report, and each might claim to be the true historical foundation. In fact, according to this theory, there is no end of probabilities and possibilities.

The theologians who first came forward as advocates of this new system were Semler, J. D. Michaelis, and J. G. Eichhorn. They directed their attacks against the deists as well as against the orthodox divines, but they confined the application of the rationalistic principle chiefly to the books of the Old Testament. Semler's principal works in this department are, 'Apparatus ad liberalem Veteris Testamenti Interpretationem,' Halle, 1773; 'Abhandlung von der Untersuchung des Kanons,' 4 vols., Halle, 1771-75, compare Semler's 'Leben, von ihm selbst verfasst,' 2 vols., Halle, 1781-82. The principal works of Michaelis are 'Einleitung in die göttlichen Schriften des alten Bundes,' 2 vols., Göttingen, 1750; 'Mosaisches Recht,' 6 vols., Frankfurt, 1770-75. Eichhorn was by far the most important writer of the school; he laid down and carried out the new principles in his 'Allgemeine Bibliothek der biblischen Literatur,' 10 vols., Leipzig, 1788-1801; 'Einleitung in das Alte Testament,' of which there appeared, in 1824, at Göttingen, the fourth edition, in 5 vols.; 'Einleitung in das Neue Testament,' in 2 vols., and several other works.

Eichhorn, whom we may consider as the representative of the new school, previous to the time when Dr. Paulus began to occupy a prominent position in it, sets out from the principle that the early history of the Jews should be considered in the same light and treated in the same manner as the early history of every other nation; and that a direct interference of the deity in the early affairs of all nations must either be admitted or denied. The reasons which led him to consider the fact of such a direct interference inadmissible in the case of other nations, led him to deny it in the case of the Jews also. Rejecting the views of the deists as unphilosophical and incompatible with the character of early history in general, he proceeds to state that it is natural to all nations in their primitive ages to speak of a divine interference in their affairs, wherever their ignorance conceals from them the real causes of the things which fall within their experience.

It is this belief, according to Eichhorn, which gives a form to all their ideas and expressions. But we, who live in a far more advanced and enlightened age, have neither reason to suppose that any miracles actually took place, nor that any kind of imposition was practised: we have only to translate the expression of those early ages into the language of our own time. In the infancy of mankind everything of which no direct cause appeared was referred to the intervention of supernatural powers; and accordingly all elevated thoughts, great determinations, useful inventions and institutions, and particularly dreams, were considered as the effects of a direct interposition of the deity; extraordinary knowledge and skill were looked upon by the people as proofs of supernatural power and of an intercourse with beings of a higher order. Moreover, not only the people, but the wise and great, were themselves fully convinced that they were acting under the immediate influence and were enjoying the especial favour of the Deity. Taking these premises for granted, and at the same time admitting that the biblical books were written by contemporaries, Eichhorn thought that all the facts of the Mosaic history might be explained as natural occurrences, without supposing, with the deists, that the writer was an impostor. The temptation and the eating of the forbidden fruit, the histories of Noah, Abraham, and Moses, are thus stripped of their supposed allegorical dress and of those features which it is supposed that they have received from the imagination of the writer, and are explained as natural events. According to Eichhorn, Moses was nothing but a great and benevolent patriot, who after having long entertained the idea of delivering his countrymen from foreign slavery, was suddenly reminded of his scheme in a dream, and believing this dream to be from the deity, he represented it as a summons from Jehovah. The burning and smoking of Mount Sinai, according to this system of exposition, were only the effect of a fire which Moses kindled on the Mount for the purpose of keeping up the excitement of his people; and a storm with lightning, which fortunately happened at the same time, was a useful aid to him. The shining of his face was nothing but the consequence of great heat and excitement, which the lawgiver as well as his people, not knowing the real cause of it, believed to be the effect of a direct interference of the deity.

This system of interpretation was, as we have observed, principally applied to the Old Testament, but the New Testament also contains passages which were too tempting to be passed over by the Rationalists. It was at first chiefly the appearance of angels in the New Testament on which Eichhorn tried the rationalistic interpretation, and all passages of this kind ought, according to this critic, to be considered as figurative expressions or allegories: thus a happy chance is represented as a saving angel; an internal joy, as the salutation of an angel; and great calmness and peace of mind, as a comforting angel, &c.

The way being thus prepared, the number of rationalistic divines increased, and their influence became apparent in many other departments of knowledge. A Utilitarian school had at the same time acquired considerable power; and so far as it endeavoured to instruct the people in the so-called useful sciences, and to do away with everything which was deemed superstitious, it went hand in hand with and supported Rationalism, which now began to be carried out in its whole extent with regard to the New as well as the Old Testament.

Among the works which gained the greatest popularity, we may mention K. F. Bahrdt, 'Briefe über die Bibel im Volkston,' 1782; Eck, 'Versuch über die Wundergeschichten des Neuen Testaments,' 1795; 'Die Wonder des Neuen Testaments in ihrer wahren Gestalt für ächte Christusverehrer,' 1799; 'Natürliche Geschichte des grossen Propheten von Nazaret,' 1800. The two last works, which were published anonymously, were written by Venturini. Most of these, and the numerous other works of the same tendency, were written in a popular style; and those of Bahrdt had often a coarse and vulgar tone. But none of these writers equalled Dr. Paulus of Heidelberg, either in learning or ingenuity; and it is he who has most completely developed the whole system of Rationalism. His principal works are—'Philologisch-kritischer und historischer Commentar über das Neue Testament,' 4 vols., Lübeck, 1800-1804 (this work was republished in 1830-33, in 3 vols., with numerous alterations and corrections, under the altered title of 'Exegetisches Handbuch über die drei ersten Evangelien'); 'Das Leben Jesu, als Grundlage zu einer reinen Geschichte des Urchristenthums,' 2 vols., Heidelberg, 1828. Paulus first insists upon the necessity of distinguishing between those passages of the Bible in which the writers simply state facts and those in which they give their own opinions of them. A fact, according to him, is that which the writers describe as having taken place within their own experience; an opinion, on the other hand, is the manner in which they interpret an occurrence and trace it to what they conceive to be its cause. But as these two elements are in most cases interwoven and mixed up with each other in the biblical writings, Paulus conceives it to be the chief object of the biblical critic to separate them, and to discover the genuine historic truth in the various disguises with which the opinions of the age and of the writer have surrounded it, and he thinks, with Eichhorn, that this object may be accomplished if the critic transports himself as much as possible to the scene of the events, and supplies such accessory and explanatory circumstances as may have been neglected or overlooked by the reporter or eye-witness. Thus the New as well as the Old Testament is deprived of its divine character, and all supernatural interference in the affairs of the Hebrews and in the introduction and establishment of Christianity is denied. Christ is no longer the son of God, but a wise and virtuous man; his miracles are either acts of friendship and humanity, and manifestations of his skill in the healing art, or the effects of a happy chance. In short, the whole history of the Bible assumes an aspect totally different from that of the original records, and from that which their authors manifestly intended; in fact it becomes a romance without any foundation except the assertion of the Rationalist that things did actually happen thus and thus.

A reaction against the spirit of this school manifested itself during the first ten years of the present century. The dreadful ravages caused by the French Revolution created a general desire to restore or maintain the good old times by returning to the religious and political institutions of past times. But although this reaction was successful in other departments, it had very little effect in theology, as it manifested itself rather in passive and retired mysticism than in energetic efforts against the system of the Rationalists. A vigorous opposition however began in 1810, which was called forth by the publication of Reinhard's 'Geständnisse,' in which Rationalism and Supernaturalism were declared to be diametrically opposed and utterly irreconcilable with each other. This assertion was denied by other theologians, who endeavoured to reconcile the two schools. The contest which then commenced, was carried on in a calm and philosophic spirit till 1817, when the centenary anniversary of the Reformation was celebrated in Germany, and the supernaturalistic party, headed by Dr. Harms of Kiel, endeavoured to make the question a practical one, and to draw to it the attention of the governments and of the whole German nation. The Rationalists were now universally decried as infidels, and as men who had forfeited all right to be called Christians; and innumerable works were written by the theologians of both parties to defend their opinions. The principal champions on the supernaturalistic side, besides Harms, were Hengstenberg and Tholuck; on the side of the Rationalists, Gesenius, Wegscheider, and Paulus. In these controversies the rationalistic theory itself almost disappeared, and the question assumed the more general character, whether the Protestant church should allow freedom of thought or not. This turn of the question induced many of the moderate Supernaturalists, who could not sacrifice their liberty of conscience, to side with the Rationalists. Their wish however was merely to bring about some kind of a reconciliation, and not to allow the question to become a national one. Their opinion was that it should be kept strictly within scientific limits, and confined to the learned. Although willing to make concessions to the Rationalists on many points, they were yet anxious to prevent any practical innovations.

After this fierce contest, which led to no decisive results, there followed a period of exhaustion and languor. The moderate party, consisting of men of both schools, increased, and repeated though fruitless attempts at reconciliation were made by them at different times. At last a complete indifference prevailed, and all hopes of producing any definite result seemed to be given up. Each party however continued to maintain its tenets. Some individuals from time to time endeavoured to renew the contest, but no lively or general interest was created on either side. One of the more important rationalistic works which appeared during this period was: 'Was heisst glauben, und wer sind die Ungläubigen?' by David Schulz, 1830.

Notwithstanding the wide breach between the two parties, approximations were made on both sides, so that the Supernaturalists as well as the Rationalists might each be divided into two parties. Some of the latter, such as Paulus, Wegscheider, Gesenius, Schulthess, Schulz, and others continued to consider reason as their only guide in matters of religion, and rejected every supernatural revelation: others, the so-called Supernaturalistic Rationalists, admitted indeed a supernatural revelation, but considered reason as the only means of recognising and acknowledging it: they thus still allowed reason to be the supreme judge in matters of religion. To this class of Rationalists belong Bretschneider, Von Ammon, Böhme, Hase, Köster, and others. A similar division exists among the Supernaturalists.

The view which the Rationalists had taken of the Scriptures contained some elements which have of late led to a new crisis in German theology. Some parts of the Scriptures, from which the Rationalists, with all their ingenuity, saw no hope of eliciting a genuine history, they had ventured to declare to be a mere legend, tradition, or mythus. This view was gradually applied to a great portion of the Old Testament, as in Bauer's *Hebräische Mythologie*, Leipzig, 1802. The various and profound investigations into antient profane history had led to similar results in other departments, and the hollowness of the Rationalist interpretation was either loudly proclaimed or tacitly acknowledged by all parties. The consequence was either a return to the supernaturalistic view, or further progress in the path which had been opened by the Rationalists themselves. Those Rationalists who could not do the former now applied the principle, to which they had formerly recourse only in cases of extreme difficulty, to the whole body of the early and miraculous portions of the Scriptures, which they placed on the same footing with the early and fabulous stories of antient Greece and Rome, and considered as a mythical history not written by eye-witnesses or contemporaries, and only recorded after it had been handed down by tradition through many generations. According to this view, all the events in the Bible are either natural events, such as occur in the history of other nations, and which must be examined according to the general principles of historical criticism, or they are of a miraculous and supernatural character, and must for this reason be rejected as not historical, like the fabulous accounts of antient mythology. As the rationalistic school directed its first attacks against the deists, so the mythical school, though diametrically opposed to the Supernaturalists, has hitherto directed its main efforts against Rationalism. We must nevertheless consider this last school as essentially rationalistic, or as a second form of Rationalism, in as far as, like Rationalism in its first form, it takes reason for its sole guide, and denies all supernatural revelation. The only difference is that it denies the Biblical records to be the works of eye-witnesses and contemporaries, and hence draws the conclusion that it is utterly impossible to elicit from those portions which are supposed to consist of mythical stories anything like a true and connected history.

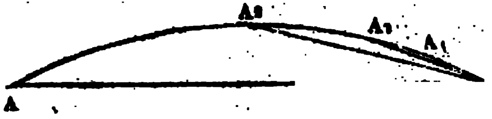
Up to the year 1835, this second form of Rationalism had been applied only partially, and chiefly to portions of the Old Testament; but it has lately been carried out in its full extent with reference to the books of the New Testament, by Dr. David Frederick Strauss, in his *Das Leben Jesu kritisch bearbeitet*, in 2 vols. The first edition appeared in 1835-36; a second was published in 1837, and a third in 1838, which is now out of print. This work, the production of a man of great learning, profound reflection, and critical skill, has called forth a host of polemical works, but the best efforts against it have been made by the supernaturalistic school. Rationalism in its first form seems to have received its death blow from this work and the various controversial writings of Strauss and others, while the new school is making rapid progress. The contest between it and the Supernaturalists is still going on, and is, with few exceptions, conducted in a calm and purely philosophic manner. Both parties have been honest enough to give way whenever any of their disputed points have been proved to be untenable. This is manifest from the 'Life of Christ' lately published by Neander, and from the different editions of the work of Strauss.

For a further account of the history of Rationalism the English reader may consult *The State of Protestantism in Germany*, by the Rev. Hugh James Rose, London, 1829; *An Historical Enquiry into the probable Causes of the Rationalist Character lately predominant in the Theology of Germany*, by Rev. E. P. Pusey, London, Part I., 1828; Part II., 1830; *Reply to the Rev. H. J. Rose's Work on the State of Protestantism in Germany*, by Dr. K. G. Bretschneider, tranlated by a Layman of the Church of England, London, 1828.

RATIOS, PRIME AND ULTIMATE. These terms were first introduced, at least in a system, by Newton, who preferred them to the terms suggested by his own method of fluxions. The first section of the Principia contains the development of their meaning, with various propositions enunciated in their language. In the articles LIMIT and INFINITE, we have already had the same notions to consider, couched in different words; but when we remember that the only sure foundation of the differential calculus, that is, of all the higher part of mathematics, must rest upon these notions, it will be worth while to dwell a little upon Newton's form of expression, and his method of employing it. The notions in question actually form part of the knowledge of many persons who are not mathematicians, and all must in some degree possess and appeal to them whose occupations lead them to any considerations connected with measurement.

All who understand the term ratio must see that the ratio of two quantities does not depend on their actual magnitudes. If one line be to another in the ratio of 3 to 7, the halves, thirds, fourths, &c. of the two lines will have the same ratio; and the subdivision into aliquot parts may be continued without limit; thus the hundred-millionth part of one line will be to the hundred-millionth part of the other as 3 to 7. Ratio then always exists, as long as there is magnitude; but if magnitude should cease to exist, and if both lines should vanish, no idea of ratio can be formed. If however the diminution take place by continual subdivision, this evanescence of magnitude never takes place; for into how many parts soever a line may be divided, each part is a length, still subdivisible for ever.

The consideration here introduced is not an easy one at first, for there is a degree of smallness which evades the senses, and reason must come to their assistance. This makes a great difficulty, for many who think themselves rational geometers are not aware how much of their ordinary perception of geometrical truth is the consequence of what they see, not of what they deduce. All magnitude is relative, so far as the notion of great or small is connected with it; we know this when we stop to think, but we do not easily take it along with us in our thoughts; there is nothing absolutely great or small, but we are continually making an absolute greatness out of magnitude which is great compared with our own bodies, and an absolute smallness of that which is in the same sense comparatively small.



Take AO, an arc of a circle, A_2O its half, A_3O its third part, A_4O its fourth part, and so on; let the chords AO, A_2O, A_3O, &c. be drawn. The points A_1, A_2, A_3, A_4, &c. constitute a series continually approaching to O in position, but never reaching it, for no aliquot part of AO is absolutely nothing. Now it can be shown that A_xO, the chord of (A_xO) the xth part of the arc, will be nearer to a ratio of equality with (A_xO) the greater x is taken, so that any approach to equality may be attained and passed by making x sufficiently great. The beginner's notion is, almost invariably, that two small quantities must be nearly equal, because they are small; and the fallacy under which they proceed is the following:—quantities which are nearly equal to the same are nearly equal to one another; small quantities are all nearly equal to nothing, therefore small quantities are nearly equal to one another. The mistake here lies partly in the use of *nothing* as if it were a quantity, having all the properties of quantity, partly in the supposition that quantities which differ little must be nearly equal. If by differing little, be meant that the difference is trifling when compared with the quantities themselves, the notion is a good one: two microscopic animalculæ are nearly equal when they differ by a small portion of an animalcula; but if they differ by the size of a gnat, though their absolute difference is still small, compared with our usual standards, the larger is immensely greater than the other. But if the just notion of nearly equal be adopted, it is wrong to say that the chord and arc are nearly equal on account of their smallness, since their small difference may possibly itself be larger than one of them. And as to using *nothing* as a quantity in the fallacious syllogism above given, it must be remembered that, with reference to possibility of subdivision, any quantity, however small, is as distant from nothing as any other quantity, however great, is from infinity.

Nevertheless, as may be rationally shown, the chord and arc are the more nearly equal the smaller they are. The conception of this proposition may be aided as follows:—

however small a line may be, we may represent it by as great a number as we please, if we take the unit of measurement still smaller, and sufficiently smaller; now let the arc taken be the nth part of the radius; then if a unit be taken so small that the arc shall be represented by $24n^2$, the chord will be a fractional number extremely near to $24n^2-1$. Thus if the arc be one-thousandth of the radius, and a unit be taken to measure it which is its 24-thousandth part, so that the arc is 24,000, the chord will contain that unit a very small fraction more than 23,999 times. And if n be made still greater, the inequality will be made still less, being capable of being made a unit out of any number we may name, however great.

In the article Limit we should say that the limiting ratio of the arc and chord is unity; in Infinite, that an infinitely small arc is equal to its chord. Newton's phrase was that the arc and chord are ultimately equal, or that their ultimate ratio is one of equality. He strives to guard this language as much as possible in the Scholium which terminates the first section, and from which we now quote.

'I have premised these lemmas, that I might avoid the tedium of long demonstration, with reductions *ad absurdum*, after the manner of the antients. Demonstrations are shortened indeed by the method of indivisibles.' [Cavalieri.] 'But since this hypothesis is somewhat difficult, and the method is not thought very geometrical, I have preferred to make what follows depend upon the ultimate sums and ratios of vanishing quantities. . . . . I do not wish to be understood as using indivisibles, but divisible vanishing quantities; not sums and ratios of determinate parts, but limits of sums and ratios. . . . .

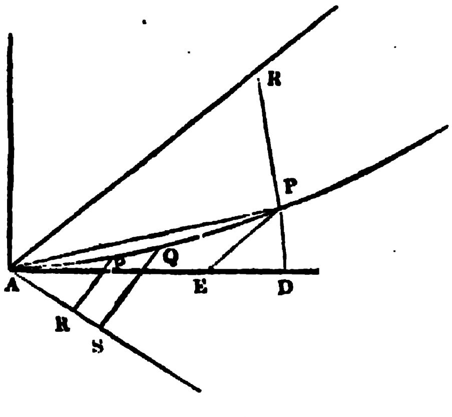
'It is objected that there is no ultimate proportion of vanishing quantities, because, before they have vanished the proportion is not ultimate, and after they have vanished there is no proportion. But by the same argument it could equally be contended, that there is no last velocity with which a body reaches the place where its motion stops; for before the body reaches its final position, it has not its last velocity, and when it reaches it, it has no velocity. And the answer is easy: by the last velocity I understand that which the body has, not before it reaches its last point and the motion stops, nor afterwards, but at the moment when it reaches, namely, that very velocity with which the body reaches its last position, and with which the motion ceases. And similarly, by the ultimate ratio of vanishing quantities, is to be understood the ratio of the quantities not before they vanish, nor after they vanish, but with which they vanish. Similarly the prime ratio of nascent quantities is the ratio with which they begin their existence (ratio quacum nascuntur). And the prime and ultimate sum is that with which (whether increasing or diminishing) they begin and cease. . . . It may also be contended, that if the ultimate ratios of vanishing quantities be given, the ultimate magnitudes will be given; and thus that every magnitude will consist of indivisible parts. . . . . But this objection proceeds on a false hypothesis. The ultimate ratios with which quantities vanish are not really the ratios of ultimate quantities, but the limits to which the ratios of quantities diminishing without limit perpetually approach, and which limits may be attained within any given difference, but can never be passed, nor even actually attained before the quantities are diminished in infinitum. The thing will be more clearly understood by speaking of infinitely great quantities. If two quantities with a given difference be increased in infinitum, the ultimate ratio will be given, that is to say, a ratio of equality, but the ultimate or greatest quantities of which this is the ratio will not therefore be given. In what follows therefore, if ever, thinking of making things more easily conceivable, I should talk of the last possible quantities, or of vanishing or ultimate quantities, do not understand thereby quantities of determinate magnitude, but think always of quantities diminishing without limit.'

This notion, whether of limiting ratios, of ultimate ratios, or of the ratios of infinitely small quantities, is a real and positive conception of our minds, but one of which, put it into what language we may, the mode of expression is liable to some objection. The ultimate magnitudes of the senses are not those of the understanding, but all our terms connected with the latter are derived from habits of thought matured by aid of the former. The ultimate arc of a curve which the eyes perceive is, to those eyes, really straight, all curvature being imperceptible. Indeed sensible straightness begins long before length vanishes. Continued reflection only will clear away the approximate truths of the senses, and enable the student to see how the ultimate truths of the theory of limits are to be established.

The first section of the Principia, consisting of eleven lemmas and the scholium from which we have quoted, opens with a lemma which should rather be the definition of the manner in which the word ultimate is used; and much objection has consequently been taken to it. 'Quantities,' says Newton, 'and the ratio of quantities, which constantly tend to equality during any finite time, and before the end of that time approach to each other within less than any given difference, become ultimately equal. If you deny it, let them be ultimately unequal, and let their ultimate difference be D, then they cannot approach nearer to equality than quantities having a difference D; which is against the hypothesis.' It is obvious that in this lemma Newton has a more decided opinion of the existence of an ultimate state of vanishing quantities, subject to all the relations of magnitude, than the expressions cited from the scholium would lead us to suppose; and the argument against those who would affirm ultimate *in*equality, is sound and conclusive. But those who would deny this lemma would oppose it on the ground that quantities which have vanished, and have ceased to be quantities, have neither ratio nor any relation of magnitude whatsoever, and the same opponents would deny inequality to such ultimate states as well as equality. A student who interprets Newton by his own subsequent expressions will consider this lemma as the definition of the sense in which *ultimate* equality is to be understood.

The second lemma asserts the ultimate equality of the area of a curve with the sum of the inscribed and of the circumscribed rectangles, and has been proved in the article Area. This lemma confines itself to rectangles standing on equal subdivisions of the base. The third proves the same on the supposition that these subdivisions are unequal; and its four corollaries assert the same ultimate equality when the inscribed figures are bounded by chords and the circumscribed figures by tangents. The fourth lemma (with a corollary) proves that if the inscribed rectangles in one curve are (or ultimately become) in a given ratio to one another, each to each (it being supposed that the same number is inscribed in both), the curvilinear areas are themselves in the same ratio.

The fifth lemma is an assertion of the properties of similar figures, curvilinear as well as rectilinear, for which we refer to Similar Figures. It appeals to a geometry supposed to be established and familiar; and it is one of the impediments to a learner of the present day in reading the Principia, that he must frequently be at a loss, when the difficulty occurs, to know whether he should look elsewhere for something more of the nature of preparation, or endeavour to conquer it by reflecting upon the position which stops him. The sixth lemma is of the same kind; it asserts that when a chord drawn from a given point of a curve diminishes without limit, the angle made by that chord with the tangent must diminish without limit, if the curvature be continuous. The proof is of that character which strongly assimilates the whole proposition to a definition of continuous curvature, making this consist in the unlimited diminution of the angle mentioned. [Tangent.] The seventh lemma (with 3 Cor.) proves that if AD be a tangent to the curve AB at A, and if BD and BE (and other such lines) be constantly drawn parallel to given lines; then, as B ap-



proaches to A, the ultimate ratio of any two of the set AE, AD, &c., the arc AB, and the chord AB, is that of equality: for a further consideration of this point, see TANGENT. The eighth lemma (with a corollary) proves that the ultimate forms of the triangles RAD and RAB (the latter whether bounded by the chord or the arc AB) are those of similar triangles; and the ninth proves that if any line AS (other than the tangent) be drawn from A, and PQ, RS be drawn parallel to any given line from points of the curve P [illegible] the ultimate ratio of the curvilinear spaces APR, AQS, will be the duplicate ratio of the ultimate ratio of AR to AS.

In the tenth lemma (5 Cor. and Scholium) it is shown that the spaces described by a point acted on by a finite force (constant or variable) in different times from the beginning of the motion, are, when those times are diminished without limit, ultimately in the duplicate ratio of the times.

In the eleventh lemma (5 Cor.) it is shown that the subtense BD (or BE, &c.) is such that different subtenses drawn from different points of the curve are ultimately in the duplicate ratio of their arcs, or of the chords of these arcs, if the curvature be finite. [TANGENT.]

The study of the theory of ultimate ratios, as given by Newton, is desirable on several grounds. The mere acquisition of the language is a benefit; for subject as all terms in which the propositions can be expressed are to misapprehension, it frequently happens that the associations which one kind of language suggests are corrective of errors which another language has allowed, or even favoured. No student can be sure that his ideas on the subject are sound until, comparing together any proposition (as in DIFFERENTIAL CALCULUS) expressed by means of infinitesimals, limits, and ultimate ratios, the same proposition in the three different ways, he feels a perfect coincidence of meaning between the three statements, and that each expresses as much as, and no more, than the others. Again, the consideration of ultimate ratios puts vividly before the mind of the student who is used to the algebraical methods, a picture of the truth which is meant to be stated, and prevents his resting upon the abstract symbols of the Differential Calculus. For want of such an accompaniment to the latter study, many have found it repulsive, more, unintelligible, at least for a long time, and some have even never arrived at any rational comprehension of its meaning.

RATISBON (in German, Regensburg), the capital of the circle of the Regen, in the kingdom of Bavaria, is one of the most antient towns in Germany, having been built by the Romans, by whom it was called Reginum, Castra Regia, and subsequently Augusta Tiberii. In the second century it was already a place of trade. Under the Agilolfingers it was the capital of Bavaria, and after the deposition of the last duke of that line by Charlemagne, towards the end of the eighth century, it was governed, under the immediate protection of the German kings, by a Count or Grave, and, like other towns which carried on considerable trade, it received the denomination of a royal city. The bishopric is said to have been founded in 740. From 1663 to the dissolution of the German empire in 1806, it was the seat of the Diet.

Ratisbon is situated in 49° N. lat. and 12° 22′ E. long., in an extensive and fertile valley, on the south side of the Danube, opposite to its confluence with the Regen. The Danube here forms two small islands, called Oberwörth and Niederwörth, which are laid out in agreeable promenades. These islands are connected with each other and with the two banks of the Danube by a remarkable stone bridge, 1100 feet in length and 23 feet wide, which was built in the years 1135-1140, and connects Ratisbon with its suburb Stadt-am-Hof on the north bank. The town is surrounded with ramparts, but not capable of defence against an enemy. The ditches have been filled up. Most of the houses are built of stone, but they are very old-fashioned, and their great height adds to the gloominess of the streets, which are narrow and crooked, but cleanly and well-paved. The most remarkable buildings are the large antient town-house, containing the hall in which the German Diet held its sittings, the Gothic cathedral, St. Peter's church, the Lutheran church of the Holy Trinity, the palace of the Prince of Thurn and Taxis, the antient abbeys of St. Emmeran, Niedernmünster, and Obermünster. The first abbey comprises a great number of buildings, resembling a little town, and has a library, a fine collection of paintings, and an excellent collection of mathematical and philosophical instruments, the new theatre, and the antient Jesuits' college. There are in all one cathedral and twenty-seven other churches and chapels, of which there are thirteen Roman Catholic and three Lutheran principal churches. Besides the library in the town-house, there are some other considerable libraries and collections of works of art; also a botanical society, a united Roman Catholic and Lutheran gymnasium, an ecclesiastical seminary, a school for the blind, and a school of design. There are extensive bleaching-grounds and celebrated breweries; and manufactories of leather, tobacco, wax candles, soap, cutlery, earthenware, porcelain, fire-arms, and carriages. The inhabitants carry on a considerable trade in salt, timber, corn, and their own manufactures, and do extensive business on commission. The population is about 21,000. Stein's Lexicon (1820), Hassel (1819), and Cannabich (1830) say that two-thirds are Roman Catholics and one-third Lutherans, which the relative number of churches seems to confirm; but Hörschelmann (1834) and the 'Conversations Lexicon' say the majority are Protestants. We believe the latter to be mistaken.

Near the city is a monument, erected in 1817, in honour of Kepler, who was born here, and on a rock on the banks of the Danube stands the Walhalla, a marble temple erected in honour of the great men of Germany. In 1809 there were great battles, for five days, between the French and the Austrians, near Ratisbon, in which the city suffered severely.

RATTLE is a term applied to a common agricultural weed, and derives its name from the dry parchment-like seed-vessels rattling, if shaken, when ripe. It grows a foot high, has narrow lanceolate serrated leaves, dilated and heart-shaped at the base, and a yellow ringent flower enclosed in a bladdery calyx. It is an annual, in many cases very common in bad pastures and meadows. We have in this country two species, the smaller and the larger; the former can scarcely be said to be injurious to the farmer, but the latter sometimes overruns corn-fields to such an extent as almost to destroy the crop, especially in parts of the country where the soil is peaty. Careful fallowing seems the only means of extirpating this kind of weed.

RATTLESNAKE. [VIPERIDÆ.]

RATZEBURG is a small principality belonging to the grand duchy of Mecklenburg Strelitz, but entirely separated from it by Mecklenburg Schwerin, being situated between the latter and the territory of Lübeck, and the duchy of Lauenburg, which belongs to Denmark. The area is 136 square miles, and the population between 14,000 and 15,000. It is traversed by the river Trave, and is bounded on the west by the lake of Ratzeburg, by means of which, and of the Wackenitz, it has a constant communication with Lübeck for the exportation of timber, corn, pulse, flax, and cattle. The inhabitants are likewise much employed in the fisheries. They have paper-mills, lime-kilns, copper and brass founderies. Ratzeburg was formerly a bishopric, but was secularised in 1648, at the peace of Westphalia.

RATZEBURG, the chief town of the principality, belongs to the duchy of Lauenburg (with the exception of the part comprehending what is called the Domhof (the close) and the Palmhof, containing 36 houses, 250 inhabitants, the cathedral school, and the hospital, which belongs to Mecklenburg Strelitz), and is the seat of the government of the principality. [LAUENBURG.]

RAUHE ALP. [GERMANY.]

RAUCHWA'CKE (in Geology), one of the calcareous members of the zechstein formation of Germany, the equivalent of the magnesian limestone formation in England. It is either compact, or cellular, or dolomitic. Associated with gypsum and with beds called stinkstein, asche, zechstein, and kupferschiefer, it makes a series of five terms which may be classed and arranged in comparison with English types and names. This is done by Von Meyer, after Sedgwick, thus:—

German.	*English.*
Asche (friable marl), and Stinkstein (thin-bedded fetid limestone).	Thin bedded limestone of Knottingley.
	Coloured marls and gypsum.
Rauchwacke (limestone).	Yellow magnesian limestone.
Zechstein (limestone).	Compact limestone.
Kupferschiefer (copper-slate).	Marl-slate.

We may perhaps prefer to view the asche, stinkstein, and rauchwacke, as altogether only one feeble upper group, comparable with the upper laminated and cellular limestones of Knottingley, and the zechstein as equivalent to our yellow magnesian limestone, in which case the kupferschiefer is on the parallel of our marl-slates (both full of fishes of the genus Palæoniscus).

(See Daubuisson's *Traité de Géologie*, vol. ii.)

RAVAILLAC. [HENRI IV.]

RAVEE. [HINDUSTAN.]

RAVELIN, a work constructed beyond the main ditch of a fortress, and in front of the curtain between two bastions. It usually consists of two lines of rampart, which meet in a salient angle on a line drawn perpendicular to and bisecting the curtain; and its form on the ground-plan may be seen at Q, *fig*. 1, BASTION, and at QQ, FORTIFICATION. Its profile, or the figure of a vertical section of its rampart, is similar to that of the enceinte. [BASTION, *Fig*. 2.]

The ravelin was probably first constructed in the place of the more antient barbacan by the Italian engineers of the sixteenth century, when, on account of the general employment of cannon in sieges, the antient towers and walls of masonry were either replaced or covered by ramparts of earth. Its original name, *rivellino*, indicates a derivation from *vegliare*, 'to watch;' and both by Maggi (1584) and Errard (1594), rivellino, or ravelin, and bastion, are used as the names of a work beyond the walls of a fortified place. In some cases the rivellino appears to have been merely a parapet of earth covering a small place of arms in which were stationed the men appointed to guard the head of the bridge leading from a postern to the counterscarp of the ditch; and a work of this kind, of a semicircular form, still exists on the exterior of the ditch on one side of Carisbrooke Castle. It can scarcely be doubted that a semicircular form was very frequently adopted for such parapets, and this circumstance may have given rise to the name of demi-lune, or half-moon, by which, even now, the ravelin is often designated. It ought to be observed however that Errard and other writers of that age apply the word ravelin to a work placed immediately in front of the salient angle of a bastion, where the counterscarp of the ditch (which is there in the form of a segment of a circle) constitutes the gorge of the work; and that the name of half-moon may, on this account, have been applied to the work, though its faces were rectilinear. A piece of fortification thus situated is now invariably called a counterguard; and the term ravelin, or demi-lune, is confined to the principal outwork in front of the curtain.

When the necessity of increasing the strength of fortresses by means of works beyond the enceinte, in consequence of the superior means employed in the attack, was strongly felt, the ravelin was made more capacious, and was provided with artillery; and, in order to prevent it from being taken by surprise, its ditch was enlarged, and the covered-way was continued on the exterior of the latter along both the faces of the work. Before the middle of the seventeenth century the ravelins were so small, that the exterior lines (the cordons) of their faces, if produced towards the rear, fell upon the curtain of the enceinte, and the lengths of the faces did not exceed 30 yards. Count Pagan then enlarged the works so that the produced faces fell at the shoulders of the bastions; but Vauban apparently, in what has since been denominated his first system, made the faces of the ravelins about 110 yards long, and directed them towards points on the faces of the bastions at 10 yards from the shoulders [Q, *fig*. 1, BASTION]. The magnitude of the work was then such as to render it capable of making a good defence: it covered the curtain and flanks of the enceinte, so that the enemy could not demolish their parapets by means of artillery in his distant batteries; and, one being placed on each front of the fortress, every two afforded not only a crossing fire on the approaches of the enemy towards the intermediate bastion, but they seriously impeded the formation of the counter-batteries on the crest of the glacis.

It was subsequently perceived that great advantages would arise if the faces of the ravelins were made still longer, and if they were directed to points at a greater distance from the shoulders of the bastions: by the first, a reverse fire, as it is called, might be directed from the angle of the work upon the enemy's lodgments on the glacis before the bastions; and by the other, the power of breaching the shoulders of the bastions by means of a battery on the glacis, before the salient angle of the ravelin, would be taken away from the enemy. At Landau and other places, Vauban, without increasing the lengths of the faces of the ravelins, directed their exterior lines to points at 20 yards from the shoulders of the bastions; while at Neuf-Brisac he not only made the lengths of the faces above 120 yards, but he directed them to points at 30 yards from the shoulders. It should be observed however that at about 20 yards from the counterscarp of the main ditch he changed the directions of the faces, and made the portion between this point and the ditch nearly perpendicular to a line joining the salient angles of the collateral bastions, as in the work Y, FORTIFICATION; by which means the second advantage, above mentioned, was lost. The intention of Vauban in thus giving flanks to the ravelin was that, by a fire from thence, the difficulty of forming a lodgment on the glacis in front of the bastion might be increased so much as to oblige the enemy to take the ravelin before he could execute such lodgment: but experience has shown that this is not the fact; for the flanks, as he has formed them at Neuf Brisac, having no work to cover their prolongations, are enfiladed, and their guns dismounted, at an early period of the siege.

Cormontaigne (1736) greatly improved the ravelin by giving it the figure represented at QQ, FORTIFICATION, making the length of each face about 130 yards, and directing that line to a point between 20 and 30 yards from the shoulders of the bastions. He reduced the terreplein, or space between its parapet and the counterscarp of the reduit Y, to 27 feet, in order that the enemy might not find room on it to form batteries for the purpose of breaching the reduit; and the faces being unbroken in direction, not only are the shoulders of the bastions covered, but the enemy is prevented from breaching any part between the shoulder and the retrenchment X. The gorge, or rear line, of the ravelin, instead of coinciding with the general direction of the counterscarp of the main ditch, is made parallel to the curtain of the place, in order to take away a part of the terreplein which would have been seen by the enemy from his counter-batteries on the glacis of the bastion. It appears that Cormontaigne wished to give the ravelins a greater length of face than that which has been mentioned, and that he was prevented from doing so through the opposition of his cotemporaries. For the advantages to be derived from very salient ravelins, see FORTIFICATION, p. 376, col. 2.

The only change which has since been made in the position of the ravelin is that which was proposed by Bousmard (1803), and followed in the works executed by order of Napoleon about Alessandria (1807). It consists in placing the work beyond the glacis of the enceinte, at the foot of which glacis its ditches terminate; the covered-way and glacis before the bastions being continued uninterruptedly along the exterior of the main ditch. It thus becomes impossible to breach the enceinte by artillery placed anywhere on the glacis of the ravelin; and, when the direction of each face is broken, as that engineer recommended, the probability of the rampart being enfiladed is much diminished. It might perhaps be objected that the ravelin so detached is liable to be attacked at the gorge; but if the covered-way of the ravelin be made to join that of the collateral bastions, and if its flanks, or those of the reduit, are disposed so as to allow a fire of musketry to be kept up in the direction by which the enemy must approach the gorge, this danger may be obviated.

The relief of the ravelin, or its elevation above the level of the ground, should be two or three feet less than that of the enceinte, in order that the defenders of the curtain may be able to direct a plunging fire into the work when it is occupied by the enemy. But if in the interior of the ravelin there should be a reduit, this last ought, for the same reason, to have less relief by two or three feet than the curtain; and then, in order to afford a plunging fire from the reduit into the ravelin, the latter should be two or three feet lower than the former. It ought however to have a command of six or seven feet over the glacis in its front, that the fire of its artillery may not annoy the defenders on the banquette of its covered-way. Therefore, if the command of the enceinte over the ground is 18 feet, and that of the glacis is seven feet, the differences between the heights of the enceinte and reduit, and of the reduit and ravelin, may be two feet successively.

RAVEN. [CORVIDÆ, vol. viii., p. 68.] We subjoin a cut of the head and foot of this species as belonging to an eminently omnivorous form.

Head and Foot of Raven.

RAVENGLASS. [CUMBERLAND.]

RAVENNA, LEGAZIO'NE DI, a province of the Papal State, is bounded on the north by the province of Ferrara, on the west by that of Bologna and by the grand-duchy of Tuscany, on the south by the province of Forli, and on the east by the Adriatic. The area is about 935 square miles, and the population 149,000. (Neigebaur; Calindri.) The eastern part of the province, which lies near the Adriatic, is low and marshy, but the western or inland part, which stretches to the foot of the Tuscan Apennines, in the neighbourhood of Imola and Faenza, is healthy, well cultivated, and thickly inhabited. The chief products of the country are corn, wine, silk, hemp, and cattle. A considerable quantity of sea-salt is derived from the lagoon of Cervia, which belongs to the government, and is a source of revenue. The principal towns of the province are RAVENNA, FAENZA, IMOLA; Cervia, a small town, in an unhealthy situation, near the sea-coast, has about 1000 inhabitants; Brisighella, near the borders of Tuscany, has about 7000 inhabitants, including its territory; and Castel Bolognese, a bustling town, in a fertile district, has about 4000 inhabitants.

The province of Ravenna is crossed by numerous streams, which rise in the Tuscan Apennines, and flow in a north-east direction to the Adriatic. The principal are — the Santerno, which flows by Imola; the Senio; the Lamone, which flows near Faenza; the Montono, which enters the sea below Ravenna; and the Ronco, which joins the Montone above its mouth.

The province is divided, for administrative purposes, into three districts:—Ravenna, Faenza, and Imola. A road leads from Faenza to Tuscany by ascending the valley of the Lamone, and, after crossing the Apennines above Marradi, descends into the valley of the Sieve, north of Florence.

RAVENNA, situated in 44° 26′ N. lat. and 12° 12′ E. long., is an antient city, once a seaport, but now five miles from the sea, which has receded all along this coast, owing to the accumulation of sand thrown up by the waves, and of the alluvial earth brought down by the rivers. The town is now in the midst of a marshy desolate plain covered with ruins, which recalls to the mind of the traveller the Campagna of Rome. Between Ravenna and the sea is the 'Pineta,' or forest of pines, which extends about fifteen miles in length along the sea-coast, and which has been noticed by Dante, Boccaccio, Dryden, and Byron (*Don Juan*, c. iii.). Ginanni has written a description of the various kinds of pines and other trees of which the forest consists: *Storia civile e naturale delle Pinete Ravennati*, 4to., Rome, 1774, with plates.

Ravenna is an archbishop's see, and the residence of the legate of the province: it has a college, and civil, criminal, and commercial courts. The population is about 18,000 (Calindri.) The cathedral, built in the fourth century, but since that time almost completely rebuilt, retains several sculptures and other remains of its early age: the baptistery, detached from the church, is still in its original state. The church of Santa Vitale was built by Justinian in imitation of Santa Sophia of Constantinople: it has some handsome pillars of granite, and a large mosaic, in good preservation, representing the emperor Justinian with his courtiers, and his empress Theodora attended by her ladies. The mausoleum of Placidia, daughter of Theodosius, and sister of Honorius, and that of her second husband Constantius, are in the vaults beneath. Ravenna has many Byzantine monuments and recollections, which give it the appearance of a Greek rather than an Italian city. The church of St. John the Baptist, was built by Placidia, as well as that of St. John the Evangelist, with its altar, made of porphyry and other valuable marbles. The mausoleum of Theodoric, which is outside of the town, has a monolithic dome, nearly 100 feet in circumference, which has been transformed into a church, called Santa Maria Rotonda. There is a portico, supported by eight granite columns, and other remains of the splendid palace of Theodoric, which was inhabited by his successors the Exarchs. Charlemagne stripped it of its ornaments, which he carried into France. The church of St. Apollinaris in Classe, so called because it was built on the site of the old port, is a magnificent structure, raised also by Theodoric, with twenty-four large columns, each of a single piece of marble, which were brought from Constantinople; and a fine mosaic, representing a view of Ravenna in the sixth century, with numerous figures of saints. The great altar is made of porphyry, verde antico, and oriental alabaster; and the pulpit, which is of marble, is of curious workmanship. Ravenna, next to Rome, is the city of Italy which abounds most with valuable and rare marbles from Greece, Asia, and Africa. The church of St. Apollinaris contains the tombs of many of the old archbishops of Ravenna, and a series of their portraits.

The other remarkable churches of Ravenna are—Santa Maria in Porto, built in the sixteenth century; St. Romuald, which now belongs to the college of Ravenna; Santa Agatha; St. Theodore; St. Domenico; St. Michele, which was transformed under the French into a fish-market; and St. Francis, which has the tombs of the Polenta lords of Ravenna. All these churches are adorned with rich marbles, valuable paintings, mosaics, and sculptures. The church of St. Lorenzo, outside of the town, built by the emperor Honorius, was destroyed in 1553, and the marble columns were carried to Rome.

The public library of Ravenna contains 40,000 volumes and 700 MSS., among which are a MS. of the plays of Aristophanes, written in the tenth century, of which Bekker made use for his edition, London, 1829. There is also a cabinet of antient medals and inscriptions, and a gallery of paintings.

The mausoleum of Dante, who died at Ravenna, was raised in the fifteenth century, by Bernardo Bembo, a Venetian podesta, and father of Cardinal Bembo: it has been repaired several times. The names of Honorius, Placidia, Theodoric, Narses, Justinian, and Dante are all associated with Ravenna.

The antient town of Classis, the port of Ravenna, which stood two or three miles south of the city, was destroyed in the year 728 by Luitprand, king of the Longobards: it is now a marsh, four miles distant from the sea. (See the antient topography of the coast about Ravenna, in Bertoldi, 'Memorie del Po di Primaro,' Ferrara, 1785.) Ravenna is 18 miles north-east of Forli, and 30 miles north-west of Rimini. A road leads from Ravenna to Rimini along the shore of the Adriatic, passing by Cervia and Cesenatico.

Ravenna is said to have been originally a town of the Umbri. It was afterwards possessed by the Boii, and formed part of Cisalpine Gaul. It is not particularly noticed in Roman history till the time of the Empire, when the port of Ravenna became one of the two great stations for the Roman fleet, Misenum being the other. Tiberius surrounded Ravenna with walls, of which the gate, or arch, called 'Porta Aurea,' is a remnant. But it was after the separation of the Eastern and Western empires that Ravenna attained its greatest importance. The harbour became the chief means of communication between the two empires; and several emperors of the West, Honorius I., his sister Placidia, and her son Valentinianus III., made Ravenna their place of residence. Afterwards Glicerius, Nepos, Orestes, and other ephemeral puppets, who succeeded each other on the throne of the West, resided likewise at Ravenna. After the fall of the empire, Theodoric made Ravenna the capital of his kingdom, and he greatly embellished the town. When Narses, the general of Justinian, having overthrown the kingdom of the Goths, A.D. 553, was appointed by the emperor, exarch or governor-general of Italy, he fixed his residence at Ravenna, which continued under his successors to be the centre of the Imperial administration in Italy, till Astolphus, king of the Longobards, took Ravenna, A.D. 752. In 755, Pepin, having defeated Astolphus, obliged him to give up Ravenna and the district called the Pentapolis to the see of Rome. But the cession was merely nominal, and the archbishops of Ravenna appear to have had the civil administration of the town and its territory, which was still called the Exarchate for a long period under the Carlovingian dynasty. [PAPAL STATE.]

In the middle ages, Ravenna, like the other towns of North Italy, was a republic, and, like them, it had its factions, which were headed by two powerful families, the Traversari and the Polenta. In the latter part of the 13th century the Polenta drove away the Traversari, and usurped the supreme power. Guido da Polenta, lord of Ravenna, was the father of the beautiful Francesca, who married Lancelot Malatesta, lord of Rimini, and, being detected by her husband in adultery with his brother Paul, was killed by him together with her paramour. This catastrophe has furnished Dante with the subject of one of his most affecting episodes (*Inferno*, v.). Dante in his banishment was the friend and guest of Guido da Polenta, who protected him in his old days and bestowed on him funeral honours after his death. The successors of Guido remained in possession of Ravenna till the year 1440, when the Venetians took it. The Venetians kept it until 1509, when it was taken from them by the French under Louis XII. In 1512 the French army under Gaston de Foix, duke of Nemours, fought a desperate battle near Ravenna against the Spanish and Papal troops. The French won the battle, but lost their commander, and soon after they were compelled to retire from Italy. Nearly 20,000 men lay dead on the field of battle, where a small marble pillar was raised on the banks of the river Ronco, and is still called 'the pillar of the French.' By the treaty of Bologna in 1530, Ravenna and its territory were given up to the pope. (Rubeis Hieronymus, *Historiarum Ravennatum Libri XI.*, fol., Venice. 1590.)

RAVENSCROFT, THOMAS, a composer and editor much esteemed at the commencement of the seventeenth century, was born in 1592, educated in St. Paul's choir, and admitted to the degree of Bachelor in Music, by the university of Cambridge, it is supposed, when only fifteen years of age. In 1611 he printed a collection of twenty-three part-songs, under the title of *Melismata, Musical Phansies*, &c., in which is his justly admired four-voiced song, 'Canst thou love and lie alone?' In 1614 appeared his *Brief Discourse*, &c., another collection of twenty part-songs, to which is prefixed a discourse or essay on the old musical proportions, a vain endeavour to rescue them from the neglect into which they had deservedly fallen. In 1621 he made some atonement for this absurd and abortive attempt, by publishing 'The whole Book of Psalms, &c. composed into four parts by sundry authors, to such several tunes as have been and are usually sung in England, Scotland, Wales, Germany, Italy, France, and the Netherlands.' Among the 'authors' appear the names of Tallis, Morley, John Milton (father of the poet), &c. Many are by Ravenscroft, who, had he only produced St. David's, Canterbury, and Bangor tunes, would have ensured the respect and gratitude of his country. The work contains a melody for each of the hundred and fifty psalms, many newly composed, and all harmonised by the above-mentioned persons. (*Supp. to Mus. Lib.*) This, we believe, is the first collection of the kind that had appeared, and, judging from the specimens that have come under our view, it is a most valuable work. [PSALMODY.] Tradition ascribes to Ravenscroft the merit of having been compiler of two other works, similar in character to the *Melismata*—namely, *Pammelia* and *Deuteromelia*, both well known to musical antiquaries, highly valued by them, and now exceedingly rare: and the tradition receives support from an allusion in the 'Apologie' to his 'Brief Discourse,' to 'Harmonies by divers and sundry authors,' formerly published by him, the errors in which, he says, are 'corrected in this (i.e. *The Discourse*) *fourth* and last work.' The *Pammelia*, comprising one hundred pieces, is dated 1609; the *Deuteromelia*, containing thirty-two, bears the same date. A selection from the four above-named secular works was privately printed in 1822, for the use of The Roxburghe Club, by the Duke of Marlborough, who unhesitatingly ascribes the *whole* to Ravenscroft, though it might have been seen at a glance that this composer was author of but a few, while he may have been editor of all.

RAWITSCH. [POSEN.]

RAY. [LIGHT.]

RAY, JOHN, or **WRAY** (as he at one time spelt his name), who may be considered as the founder of true principles of classification in the vegetable and animal kingdoms, was the son of a blacksmith, and was born at Black-Notley near Braintree in Essex, on the 29th of November, 1627. He received a good education, being sent first to the grammar-school at Braintree, and afterwards to the university of Cambridge, where he entered at Catherine Hall, but subsequently removed to Trinity College, of which he was elected a fellow in 1649, together with Isaac Barrow. At the age of twenty-three he was appointed Greek lecturer, and two years afterwards mathematical tutor to his college. He was also private tutor to several gentlemen of rank, and among others to one who possessed a kindred spirit to himself, and whose name afterwards became closely associated with his own in the paths of science, Francis Willughby. Ray was always fond of the study of natural history, but it is recorded by his biographers that the circumstance which chiefly gave rise to his cultivation of the science of botany (in which he afterwards became so distinguished) was an illness, for the removal of which he was recommended to take frequent exercise out of doors. Being compelled to remit his drier studies, he collected and investigated the different wild plants which he met with in his walks about Cambridge, and in 1660 published a 'Catalogus Plantarum circa Cantabrigiam nascentium,' 1 vol. 8vo., which he says took him ten years to compile.

During his residence at the University he travelled over the greater part of England, Wales, and Scotland, in the pursuit of botanical and zoological information, and was generally accompanied in these excursions by his friend and pupil Mr. Willughby. At the Restoration he took orders, but never held any church preferment, nor performed regular parochial duty; and two years afterwards he was obliged to resign his fellowship in consequence of the passing of the Act of Uniformity, to which he could not conscienciously subscribe. After leaving the University he resided chiefly with Mr. Willughby at Middleton Hall in Warwickshire, and devoted the remainder of his life solely to the pursuit of natural history. In 1663 he embarked for the Continent with Mr. Willughby, where they remained for three years travelling through the Low Countries, Germany, Italy, Switzerland, and France; and collecting information respecting the animals and plants which inhabit these different countries. Willughby attended chiefly to zoology, and Ray to botany. An account of this tour was published by Ray in 1673, 1 vol. 8vo. In 1667 he was elected a fellow of the Royal Society, to the Transactions of which learned body he contributed some valuable papers. In 1672 he had the misfortune to lose his friend Mr. Willughby, who died at the age of 37, leaving him guardian to his two sons (the younger of whom was afterwards created Lord Middleton) and a legacy of 60*l.* per annum. After superintending the education of Mr. Willughby's children for some time at Middleton Hall, he removed to Sutton Coldfield, in Warwickshire, and then to Falkbourn Hall, Essex, and lastly he settled in 1679 at Black-Notley, his native place, where he remained till his death, which took place January 17, 1704-5, at the age of 77. In 1673 he married a young lady 24 years younger than himself, by whom he left three daughters. Ray was not more respected for his scientific acquirements than for his benevolence, which was combined with high moral and religious worth.

Ray left many works, among which the botanical and zoological hold such a conspicuous place in the history and literature of those sciences, that they demand a brief n[illegible] His first publication was the 'Catalogue of the Plants growing in the neighbourhood of Cambridge,' which we have already mentioned. This work contains a description of 626 species arranged alphabetically, and accompanied with the synonyms of the principal botanical authors who had preceded him: it is curious, from its being the first production of a man who afterwards attained to such great celebrity, and it exhibits traces of those singular powers of observation which he afterwards so eminently displayed. In the preface, which in this, as in most of his other works, contains much interesting matter, he describes the difficulties which he had to overcome in the prosecution of his botanical studies, the principal of which was the want of some acknowledged guide which he might follow in the determination of species. Many curious notes are introduced into this catalogue, which have not only reference to the structure and properties of the plants themselves, but to other parts of natural history, particularly entomology, to which he appears to have already paid considerable attention: among other facts he observed the hermaphroditism of the snail. A supplement to this catalogue appeared in 1663, and a second in 1685.

In 1682 appeared his 'Methodus Plantarum Nova,' 1 vol. 8vo., in which he proposed a new method of classifying plants, which, when altered and amended, as it subsequently was by himself at a later period, unquestionably formed the basis of that method which under the name of the system of Jussieu is universally received at the present day. In the formation of the principal groups into which he divided the vegetable kingdom, Ray derived his characters sometimes from the fruit, sometimes from the flower, and sometimes from other parts of the plant, as each in its turn seemed to offer the most strongly marked points of distinction. He first proposed the division of plants into dicotyledons and monocotyledons. 'Floriferas dividimus,' he says, 'in *dicotyledones*, quarum semina sata binis foliis anomalis seminalibus dictis quæ cotyledonum usum præstant è terra exeunt, vel in binos saltem lobos dividuntur quamvis eos supra terram foliorum specie non efferant; et *monocotyledones*, quæ nec folia seminalia bina efferunt nec lobos binos condunt.'[*] He extended these divisions both to trees and herbs, stating that palms differ as much in this respect from other trees, as grasses and lilies do from other herbs. Though he made these great discoveries and improvements, Ray obstinately continued in the old error of separating woody from herbaceous plants, or trees from herbs, and he held a long controversy with Rivinus on this point: he even went so far as to state that one of these divisions might be distinguished from the other by the presence of buds, which he says are only developed in woody plants. To him is due however the honour of the discovery of the true nature of buds, for he says that they are points at which new annual plants spring up from the old stock, but he stopped short in his discovery in not extending them to herbaceous plants. In the first edition of the 'Methodus' he formed 25 classes, taking the woody plants first, which he divided into trees and shrubs. In this system he fell into many errors, one of the most glaring of which, as he himself afterwards observed, was the separation of the different species of corn from the other grasses. He subsequently altered this, and revised the whole arrangement, making 34 groups instead of 25; many of which are almost exactly the same as are adopted by botanists of the present day under the name of natural orders. The following table, taken from the second edition of his 'Methodus,' published in 1703, will give an outline of his system:—

Herbaceous plants and undershrubs not bearing buds	Imperfect or without visible flowers . . .	1. Submarine plants.
		2. Funguses.
		3. Mosses.
		4. Capillary.
	Perfect or flowering plants:— Dicotyledones	5. Stamineous, *i.e.* Apetalous.
	Flower compound	6. Planipetalous, milky.
		7. Discoid with pappus seed.
		8. Corymbiferous.
		9. Capitale.
	Flower simple:—	
	With 1 naked seed	10. Monospermous.
	With 2 naked seeds	11. Umbelliferous.
		12. Stellate.
	With 4 naked seeds	13. Rough leaved.
		14. Verticillate.
	With many naked seeds . . .	15. Polyspermous.
	Seeds coated with pulp . . .	16. Pomiferous.
		17. Bacciferous.
	In several distinct vessels . . .	18. Multisiliquous.
	In a single vessel	19. Monopetalous and dipetalous plants.
		20. Siliquose.
		21. Leguminose.
		22. Pentapetalous.
	Monocotyledones, or grass leaved:—	
	Bearing flowers	23. Bulbous or not bulbous.
	Without proper flowers . .	24. Stamineous grasses.
		25. Anomalous plants.
Trees or shrubs bearing buds.	Monocotyledones: with arundinaceous leaves . .	26. Palms
	Dicotyledones:—	
	Flowers remote from fruit .	27. Coniferous.
	(Monœcious or diœcious) . .	28. Not coniferous.
	Flowers contiguous to fruit:—	
	Fruit	29. Umbilicated.
		30. Not umbilicated.
		31. Dry, not siliquose.
		32. Siliquose.
	Flower . . .	33. Papilionaceous.
		34. Anomalous plants.

This arrangement was too far in advance of the knowledge of the day, and the consequence was that it was little appreciated or adopted by his contemporaries and immediate successors, who, instead of improving the arrangement so ably sketched out, set about establishing others on artificial principles, all of which are rapidly sinking into oblivion, while the principles of Ray are tacitly admitted, and many of his fundamental divisions adopted in that beautiful but still imperfect natural system which has been formed by the labours of Jussieu, Brown, De Candolle, Lindley, and others.

While he made these important improvements in classification, this great botanist did not neglect the study of species; his 'Catalogus Plantarum Angliæ' first appeared in 1670, arranged alphabetically, and has been the basis of all subsequent Floras of this country. A second edition appeared in 1677, and in 1690 he published a third, entitled 'Synopsis Methodica Stirpium Britannicarum,' which is arranged according to his natural system. Another edition of the 'Synopsis' came out in 1696, and it was again republished by Dillenius in 1724. This work, of which the edition of 1696 is the best, is very accurate. Ray examined every plant described in the work himself, and investigated their synonyms with great care.

In 1694 he published 'Stirpium Europæarum extra Britannias crescentium Sylloge.' This work contains a description of all those plants which he had himself collected on the Continent, as well as many which had been described by others. The synonyms are here very exact.

His largest botanical work was a general 'Historia Plantarum,' the first volume of which came out in 1686, fol.; a second appeared in 1688; and a third, which was supplementary, in 1704. In this vast work he collected and arranged all the species of plants which had then been described by botanists; he enumerated 18,625 species. Haller, Sprengel, Adanson, and others speak of this work as being the produce of immense labour, and as containing much learning and acute criticism; but from its nature it was of course principally a compilation.

Ray made many researches in vegetable physiology. He published a very interesting paper in the 'Philosophical Transactions' (No. 68), on the mode of ascent of the sap, and we find many observations on the structure and functions of plants scattered through his various works. In the first volume of the 'Historia Plantarum' he collected together, under the title of 'De Plantis in Genere,' all the principal discoveries which had been made on the structure and properties of plants by Cesalpin, Grew, Malpighi, and others, as well as by himself; so that he thus published by far the most complete introduction to botany that had then appeared.

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[*] 'Methodus Plantarum,' edit. 2, p. 2.

In zoology Ray ranks almost as high as in botany; and his works on this subject are even more important, as they still in a great measure preserve their utility. Cuvier says, that 'they may be considered as the foundation of modern zoology, for naturalists are obliged to consult them every instant, for the purpose of clearing up the difficulties which they meet with in the works of Linnæus and his copyists.' Mr. Willughby, at the time of his death, left to his friend Ray the task of arranging and publishing the various materials which he had collected for an extensive work on the animal kingdom. Ray exhibited as much zeal as fidelity in the execution of this trust, for he might have called the works partly his own without much injustice, as he had assisted in the first collection of the materials, and had the entire task of arranging and classifying them; besides which, it is easy to observe, as Cuvier has remarked, that the histories of plants and animals are both written by the same hand.

The 'Ornithologia' of Willughby, which was the first part of the work that appeared, was published in 1676, one vol. fol., with seventy-seven plates. An English translation of it, by Ray, appeared the following year. The remaining part, which is the most complete, was the 'Historia Piscium,' and did not come out till 1686, 2 vols. fol. These works contain a great number of new species of birds and fishes, which had been discovered by Willughby and Ray in Germany and Italy, as well as those which had been previously described. Cuvier says, 'the fishes of the Mediterranean are described with rare precision, and it is frequently easier to find species in Willughby than in Linnæus.' Many of the figures in these works are original, and very good.

Ray published several works of his own on zoology. He undertook to form a classical arrangement of the whole animal kingdom, as he had of the vegetable; and, in 1693, he published his 'Synopsis Methodica Animalium, Quadrupedum, et Serpentini Generis,' one vol. 8vo. Similar volumes on birds and fishes were also prepared by him, but were not published till after his death, by Dr. Derham, in 1713. The two last are principally abridgments of the great works published under the name of Willughby. He also left a history of insects, which was likewise published by Dr. Derham, at the expense of the Royal Society, and contains an appendix on beetles, by Dr. Lister. This last work is remarkable for the numerous and accurate descriptions of insects which it contains, part of which, he says, had been prepared by his friend Mr. Willughby. The author here rejects the theory of spontaneous generation. The most important character of the zoological works of Ray is the precise and clear method of classification which he adopted. The primary divisions of his system were founded on the structure of the heart and organs of respiration. His arrangement of the classes of quadrupeds and birds has been followed by many naturalists. Both Linnæus and Buffon borrowed largely from the works of Ray. Buffon extracted from Willughby's 'Ornithology,' almost all the anatomical part of his history of birds; and Cuvier says that the 'Dictionnaire d'Ichtyologie,' by Daubenton and Haüy, in the 'Encyclopédie Méthodique,' consists in great part of translations from Ray's works on fishes.

In addition to his numerous scientific writings, Ray composed several works on divinity and other subjects: the best known of these are, 'A Collection of Proverbs,' which came out in 1672, and went through several editions; 'The Wisdom of God in the Creation,' 1690, which also had an extensive sale; 'A Persuasion to a Holy Life,' 1700; and three 'Physico-Theological Discourses concerning Chaos, the Deluge, and the Dissolution of the World,' 1692.

(*Life*, by Dr. Derham; Haller's *Bibl. Bot.*; *Life*, by Cuvier and Du Petit Thouars, in the *Biog. Univer.*; and *Life*, by Sir J. E. Smith, in Rees's *Cyclop.*)

RAYED or RADIATED ANIMALS, *Radiaria* or *Radiata*, Lamarck's name for a class of invertebrate animals, which he divides into the *Radiaires Molasses* and the *Radiaires Echinodermes*. Of the former, the *Medusæ* are an example [PULMOGRADA]; the latter consist of the ECHINODERMATA. The class is treated of under the article STELLERIDIANS.

RAYMOND, Counts. [LANGUEDOC.]

RAYMUND LULLY. [LULLY.]

RAYNA'L, GUILLA'UME THOMA'S FRANÇOIS, born in 1711, at St. Geniez, in the province of Rouergue, now the department de l'Aveyron, studied in the Jesuits' College at Pézénas, and took orders as a priest. He afterwards left the Jesuits, and came to Paris, where he was made assistant-curate of the parish of St. Sulpice, in 1747. It is stated, in the 'Biographie Universelle,' that he was dismissed from the service of that parish in consequence of simoniacal practices; among others for exacting illegal fees for performing the office of the dead. He next turned to literary pursuits, and having made himself acquainted with several influential men, he became editor of the 'Mercure de France.' He also wrote 'Histoire du Stathouderat,' 12mo., 1748, which has been reprinted several times: the last edition is that of Paris, 1819, with additions. It is a superficial work, and written in a declamatory style. His 'Histoire [illegible]rlement d'Angleterre' is equally superficial and inaccu[illegible] From these and his 'Anecdotes Littéraires,' 'Anecdotes historiques, militaires, et politiques,' and other similar light works, he derived a considerable profit. At the same time Raynal speculated in mercantile affairs, and, it is said by Désessart, in his 'Siècles Littéraires de la France,' that he employed capital in the slave-trade. At Paris he frequented the society of Helvetius, Holbach, and Madame Geoffrin.

In 1770 he published his great work, by which he is chiefly known, 'Histoire Philosophique des Etablissemens des Européens dans les deux Indes,' 4 vols. 8vo., La Haye, without the author's name. The work was reprinted several times, both in France and out of France, with additions by the author; and although many passages were written in a very violent tone against monarchy, and especially the French monarchy, and against Christianity, the French government allowed the book to circulate undisturbed. In the meantime Raynal travelled in Holland and England, and collected fresh materials for his work, of which he published a new and enlarged edition at Geneva, 10 vols. 8vo., 1780, with his name and his portrait.

The French authorities now took notice of the book. In May, 1781, the parliament of Paris condemned it to be burned by the hand of the executioner, and ordered the author to be arrested and his property sequestrated, but his friends in office gave him timely notice to quit France and to place his property in safety. Raynal repaired to Spa, where a young Belgian addressed to him a laudatory epistle, 'La Nymphe de Spa à l'Abbé Raynal,' which drew upon the author the censure of the prince bishop of Liege, the sovereign of the county. Raynal replied by another letter, in which he abused the clergy, and bishops in particular, in the most virulent manner. He had long since openly renounced his priestly character, and spoke of himself as 'having been once a priest.' From Spa he repaired to Saxe-Gotha, and from thence to Berlin, where he sought an audience of Frederic the Great, who, being displeased at some passages of his work which reflected upon himself, declined seeing him for a long time, until at last, Raynal having made a written application, Frederic gave him an audience at Potsdam, made him sit down, and talked to him about his former histories of the Stathouderat and of the parliament of England. Raynal eagerly said that he had written more important works since. 'I am not acquainted with them,' replied Frederic drily, thus putting an end to further remarks on that topic. (Thiébault, *Mes Souvenirs de Vingt Ans de Séjour à Berlin.*) Frederic afterwards wrote to D'Alembert concerning his interview with Raynal, who, he said, spoke much about the wealth, the resources, and the power of nations, and in so positive a manner, 'that, in listening to him, I almost fancied that I was listening to the voice of Providence.' In 1787, Raynal was allowed to return to France, but not to Paris. His friend Malouet, who was intendant-general of the navy at Toulon, received him hospitably in his house. Raynal marked his residence in the south of France by several acts of beneficence and philanthropy, as he had done previously during a journey in Switzerland. Droz, in his 'Histoire du Regne de Louis XVI.,' says: 'Raynal was a good-hearted man, easy and mild in his manners; but the obscurity in which his former works had left his name irritated his vanity

Fearing that the valuable materials which he had collected in his principal work on the trade of the East and West Indies might not be sufficient to attract public attention to himself, he interspersed his narrative with republican disquisitions, licentious descriptions, and contradictory assertions, which he lived to regret. It is well known that the most reprehensible passages of this compilation belong to Diderot, but Raynal shared the responsibility by adopting them as his own.' Turgot, in a letter which is found in the 'Mémoires de l'Abbé Morellet,' thus characterises Raynal's history:—'Whilst I admired the talent of the author, I have been somewhat shocked at the inconsistency of his ideas, and at seeing so many conflicting paradoxes put forward, and all supported with a like warmth, a like eloquence, and a like fanaticism. He is at times immoral, like Helvetius, and at others a rigorist, like Richardson; now he speaks with enthusiasm of mild virtues, and now he extols with an equal warmth savage courage and lust; he pretends to detest slavery, and yet he thinks there must be slaves; he reasons badly in physics, badly in metaphysics, and also often in politics. You gather no fruit from his book; you perceive that the author is a very clever [illegible] possessed of extensive information, but who has no[illegible] ideas, and is carried along by an enthusiasm worthy [illegible] young rhetoricion.'

Raynal's work is a fair sample of that species of composition which was known in the last century by the name of 'philosophical history,' the specimens of which have been greatly multiplied, especially in France, and have largely contributed to lead astray the minds of the people on subjects of morality and politics by confounding their ideas of right and wrong. It is one of those works which, by glowing descriptions of wrongs inflicted in ages past, accumulated as it were in one view, are apt to excite feelings of indignation and revenge against whole classes of living persons who are innocent of those evils, but who are considered as the representatives of the former perpetrators, such as kings, nobles, and priests, and which, by stimulating all the passions and removing all checks upon self-gratification, are calculated to loosen the bonds of society; leaving to the chances of futurity the task of reconstructing something on the desolation which they have helped to effect.

The distribution of Raynal's work is as follows:—Book i. is on the discoveries of the Portuguese, and their conquests in and trade with India; ii., on those of the Dutch; iii., of the English; iv., of the French; v., of the Danes, Swedes, and other northern nations; vi., vii., and viii., Conquests of the Spaniards in America; ix., of the Portuguese in Brazil; x. to xiv., Colonization of the West India Islands; the eleventh book treats of the slave-trade; xv. to xviii., Settlements of the French and English in North America; book xix. consists of general reflections on the state of society, on religion, government, war, commerce, agriculture, manufacture, population, taxation, public debt, the fine arts, sciences, philosophy, and morality, terminating with a summing up of the good and the evil derived to Europe from the discovery of America. [COLONIES.]

Raynal's work has been the subject of many strictures, refutations, and corrections. A Virginian wrote 'Recherches Historiques et Politiques sur les États Unis de l'Amerique Septentrionale,' 4 vols. 8vo., Paris, 1788. A Dutchman published, in 1791, one volume of extracts from Raynal's book concerning the commerce of the Dutch colonies. The duke of Almodavar extracted and translated into Spanish the part concerning the colonies of Spain, and refuted several fallacies. An anonymous writer published 'Observations sur plusieurs Assertions extraites littéralement de l'Histoire Philosophique des établissement des Européens dans les deux Indes,' 8vo., Amsterdam and Paris, 1776.

When the first symptoms of the French Revolution showed themselves, Raynal was elected by the city of Marseille as their representative in the states-general. He declined the honour on the plea of old age; but the fact was that his opinions had undergone a great change. In December, 1790, a letter appeared in the papers, purported to be addressed by Raynal to the National Assembly, expressive of his altered sentiments on political subjects. This however was disavowed by Raynal's friends; but on the 31st of May, 1791, Raynal did address an eloquent letter to Bureau de Puzy, president of the National Assembly, in which, after drawing a gloomy sketch of the state of France, of the persecutions of the clergy, of the inquisitorial power exercised against opinions, of the disorders and violence of every sort which were daily perpetrated by mobs with impunity, and all in the name of liberty, he stated his regret that 'he was one of those who, by expressing in his works a generous indignation against arbitrary power, had perhaps been the means of putting weapons into the hands of licentiousness and anarchy.' This letter, being read publicly by the president, occasioned a violent storm in the Assembly. Roederer called the president to order for reading the letter. ('Moniteur,' 31st May, 1791.) Journals and pamphlets vied with each other in abusing Raynal as a renegade and a dotard. Raynal however remained quiet in the neighbourhood of Paris; he passed unmolested through the period of terror; and he died in March, 1796, at the house of a friend at Chaillot. Just before his death the Directory had named him member of the National Institute, and his 'éloge' was read by Lebreton at one of the first sittings of that body.

A new edition of Raynal's 'History' was published at Paris in 11 vols. 8vo., 1820-21, with a biographical notice and reflections on the works of Raynal, by M. A. Jay.

The following works have been erroneously attributed to Raynal: 1, 'Inconvénients du Célibat des Prêtres' (by the Abbé Gaudin); 2, 'Des Assassinats et des Vols Politiques sous le Nom de Proscription et de Confiscations' (by Servan).

RAZOR-SHELL, the vernacular name for the shells of some species of the genus *Solen*. [PYLORIDEA, p. 146.]

RAZZI, CAVALIERE GIOVANNI ANTONIO, called **IL SODOMA**, an eminent painter, was born about the year 1479, according to some, at Verceil in Piedmont, and as stated by others at Vergelli, a village near Siena. It is certain however that he received the right of citizenship at the latter place. He was instructed, according to Vasari, by Giacomo dalle Fronte, but he chiefly formed his principles by an attentive study of the works of Leonardo da Vinci. M. Périès, in the 'Biographie Universelle,' observes that his flesh-colours, his style of chiaroscuro, and other qualities inherent in the old Milanese school and in that of Girolamo Giovenone, who flourished at Verceil, during the earlier years of Sodoma, leave traces of the manner of that master, especially in the works which were executed in the earlier period of his career of celebrity. Among his earliest performances were the pictures he painted in 1502, at Monte Oliveto, representing the history of S. Benedetto. He was employed at Rome, in the pontificate of Julius II., to decorate part of the Vatican; but his works, with those of some other artists, not being to the taste of his holiness, were removed to make way for the frescoes of Raffaello. Some grotesques however from his hands were preserved. In the Chigi Palace, now called the Farnesina, are some of his pictures, representing the history of Alexander the Great, the most noted of which is the Marriage of Roxana, which were executed by order of Agostino Chigi, and which Mr. Fuseli considers to possess much of the chiaroscuro though not the dignity and grace of Leonardo da Vinci, and to be remarkable for beauties of perspective and playful imagery. At Siena he painted many works. The Adoration of the Magi, which is in the church of S. Agostino, resembles the style of Leonardo da Vinci, and some amateurs prefer the Scourging of Christ, his chef-d'œuvre, which is in the convent of S. Francisco, to the same subject by Michael Angelo; nor is the Swoon of St. Catherine of Siena, painted in fresco, in one of the chapels of S. Domenico, unworthy of the pencil of Raffaello. The St. Sebastian, in the gallery at Florence, is supposed to be painted from an antique torso. M. Périès also mentions a picture of the Sacrifice of Abraham, painted for the cathedral of Pisa, which was in the Louvre in 1814, and was returned to Tuscany in 1815, in which, although the light is distributed in too small masses and somewhat scattered, the forms exhibit great knowledge of art, and there is an admirable expression of truth in the figures.

He is said by Lanzi to have frequently painted in a hurried manner, without any preparatory study, especially in his old age, when, reduced to poverty at Siena, he sought employment at Pisa, Volterra, and Lucca; but still, though careless of excellence, Sodoma never painted badly, and in all his pictures the traces of an able artist are visible; and Mr. Fuseli observes, when alluding to the same circumstance, 'in all his works we trace the master-hand, which, in spite of negligence, performs with power.' Vasari seems to have been a systematic opponent of Sodoma, and gene rally styles him a buffoon, 'but,' says Lanzi, 'Giovio has written of Razzi in a different manner; when speaking of the death of Raffaello, he subjoins: 'plures pari pene gloriâ certantes artem exceperupt, et in his Sodomas Vercellensis.' He who objects to the testimony of this eminent scholar, will receive that of a celebrated painter: Annibale Caracci, passing through Siena, said, 'Razzi appears a master of the very highest eminence and of the greatest taste, and (speaking of his best works at Siena) few such pictures are to be seen.'

He seems to have had many pupils, the principal one of whom was Bartolommeo Neroni, generally called Maestro Riccio. Sodoma died in the year 1554, and is placed by Lanzi in the second epoch of the Sienese school. (Lanzi, *Storia Pittorica*, i. 280; *Biographie Universelle;* Pilkington's *Dictionary*, by Fuseli; Bryan's *Dictionary*.)

RE, in Music, the name given by the Italians and French to the second note of the diatonic scale, and generally throughout Europe to the second of the syllables used in SOLMIZATION.

RE′, or RHE′, ILE DE. [CHARENTE INFERIEURE.]

READING, the county town of Berkshire, situated in the hundred of Reading, but with separate jurisdiction, on the river Kennet, just above its junction with the Thames, 38 miles in a direct line west of St. Paul's, or 42 miles from the General Post-office by Brentford, Hounslow, and Maidenhead.

The first mention of Reading is in the year 871, when it was occupied by the Danes, who had thrown up an intrenchment between the Kennet and the Thames, to defend the tongue of land on which the town stands. They repulsed an attack of the West Saxons, under their king Ethelred and his brother Alfred, but quitted the town towards the close of the year. In A.D. 1006 it was burnt by the Danes, who destroyed an abbey of nuns, on the site of which a new abbey was erected by Henry I., who was buried here. In the civil war of Stephen and Maud, the town and castle changed hands more than once. It is supposed that the castle was demolished soon after that time. In the following reigns the kings frequently resided at Reading, and parliaments were held here. On the dissolution of the abbey, the buildings were appropriated as a royal palace. In the civil war of Charles I. Reading was made a parliamentary garrison; but Henry Marten, the governor, with the garrison, fled on the approach of a party of royalist cavalry (November, 1642), and the town was garrisoned by the king. In April, 1643, the Parliamentarians, under the Earl of Essex and General Skippon, besieged the town, and took it, after a faint resistance. The Royalists, under Prince Rupert, who had attempted to relieve it, were repulsed, at Caversham Bridge, near the town. Sir Arthur Aston, who had the command of the garrison, was wounded, and Colonel Fielding, who took the command, was condemned to death for the surrender, but pardoned. After the first battle of Newbury (September, 1643), the town was again occupied by the king, who left a garrison under Sir Jacob Astley, but in May, 1644, the Royalists quitted the town, which was finally occupied by the Parliamentarians. Reading suffered severely from being so long a garrison town. In the Revolution of 1688, the troops of James II. occupied the town: a slight skirmish took place here, and the king's forces speedily retired.

The town lies partly between the Kennet and the Thames, partly on the south side of the Kennet; it comprehends the three following parishes:—

	Area in Acres.	Population in 1831.
St. Giles . .	480	4749
St. Lawrence .	340	4048
St. Mary . .	1260	6798
	2080	15,595

The town altogether is very irregularly laid out. The parish of St. Lawrence, which is on the north-east side of it, occupying the point of land at the junction of the Kennet with the Thames, is probably as much covered with buildings as ever it will be, the unoccupied part consisting of low marshy meadows along the bank of the Thames; it contains the market-place, and two of the best streets in the town for business. The parishes of St. Mary on the west, and St. Giles on the south-east, contain portions of the trading part of the town. A large portion of the poorer classes reside in St. Mary's. St. Giles contains the residence of most of the gentry and persons of independent fortune. It is the favourite part of the town for building on, and several new streets and squares have been laid out along the London road. The town is well-paved, and lighted with gas, and amply supplied with water from the Kennet. The houses are in general substantial, and built of brick; but there are some old ones of lath and plaster, with high gables. St. Lawrence's church appears to have been considerably repaired in 1434, but there are some portions of the original structure of Norman character; it consists of a nave and north aisle, separated from each other by a row of octagonal pillars, supporting five elliptical arches with ogee mouldings, and a chancel. There is a fine tower at the west end, of perpendicular character, and of chequered flint-work; it has a peal of ten bells. St. Mary's church consists of a nave, south aisle, a small north aisle, and a chancel: it was rebuilt about 1551, chiefly from the materials of the abbey church, then pulled down; it has a tower of similar character to that of St. Lawrence, but not equal to it. A large part, if not the whole, of the exterior part of the church is of chequered work. St. Giles's contains little that is remarkable. The town-hall is a modern building, over a part of the free-school; and there is a building termed (for what reason is not known) 'the oracle,' erected by Mr. John Kendrick, a great benefactor to the town, early in the seventeenth century, for the employment of the poor; the principal gateway, which is the most striking portion, is of mingled Gothic and Grecian architecture. As the river Kennet has a divided channel, there are many bridges; that over the main stream, in Duke Street, is a handsome stone bridge of one arch, with balustrades. There are some ruins of the abbey, especially one of the gates, and also some interesting remains of the abbey mill.

The trade of the town is considerable. There was antiently a large manufacture of woollen cloth, but it has become extinct. Some silk ribands and galloons are woven, and some floor-cloth and sail-cloth is made. There are iron foundries, breweries, and yards for boat-building. Trade is carried on in corn, seeds, malt, timber, bark, hoops, wool, cheese, and beer. There are markets on Wednesday and Saturday, the latter chiefly for corn; and four yearly fairs, one a large cheese-fair. The Kennet is navigable to the Thames, and the Kennet and Avon canal affords a water-communication with the west of England. The Great Western railway passes the town, and the main road from London to Bath and Bristol runs through it.

Reading claims to be a borough by prescription; the earliest known charter is of 37 Henry III., A.D. 1253. The corporation, by the Municipal Reform Act, consists of six aldermen and eighteen councillors; the town is divided into three wards. The spring assizes, and the Epiphany, and occasionally, though rarely of late years, the Michaelmas sessions for the county, are held here; and there are quarter-sessions for the borough, a court of record for causes not exceeding 10*l.* in amount, and a court leet, holden by the corporation as the lords of the manor. Petty-sessions are held here weekly for the division. There is a small borough gaol, altogether unfit for its purpose; and a county gaol, of very defective construction, so as to preclude the carrying into effect of many arrangements which the good discipline of the prison requires.

Reading is one of the polling-stations for the county. Two members of parliament are returned by the borough. It has possessed the right of election from 23 Edward I.; it was a scot and lot borough. The number of electors in 1835-6 was 977.

The living of St. Giles is a rectory, of the clear yearly value of 522*l.*, with a glebe-house; that of St. Lawrence is a vicarage, of the clear yearly value of 276*l.*, with a glebe-house; and that of St. Mary a vicarage, of the clear yearly value of 661*l.*, with a glebe-house. There is a chapel-of-ease in St. Mary's parish, and there are several dissenting chapels and a Catholic chapel in the town. Reading is in the archdeaconry of Berks, which the Ecclesiastical Commissioners have proposed to transfer from the diocese of Salisbury to that of Oxford.

There were in the borough, in 1833, two infant-schools, with 193 children; thirty-five day-schools or boarding and day schools, with 720 boys, 406 girls, and 80 children of sex not mentioned; three day and Sunday schools, with 502 scholars in the week and 651 on Sundays; and sixteen Sunday schools, with 698 boys and 630 girls. One of the day-schools is a free grammar-school, of which the late Dr. Valpy was for many years master. Several of the other schools are supported, at least in part, by endowments or subscription.

There are a public library and news-room, called the Reading Institution, a subscription news-room, a small theatre, and baths. There are several almshouses, and a dispensary.

REAL ESTATE. [PROPERTY.]

REALEJO, a seaport on the Pacific, in Central America, in the republic of Nicaragua, and in the department of Leon, in 12° 30′ N. lat. and 87° 7′ W. long. The harbour is formed by a small bay, at the entrance of which are two islands, called El Cardon and El Castanon. Vessels enter the harbour by the strait which separates these two islands. The harbour is spacious and safe, and has good anchoring-ground. The town is built on the northern shores of an inlet near the bay: it contains a population of less than 3000, but if that of the neighbouring village of Chinandego is included, it hardly falls short of 15,000. The inhabitants are chiefly merchants and persons occupied in ship-building, for which the neighbouring forests supply abundance of timber. Ship-building is a large branch of industry, and there are docks for that purpose. The commerce with the other republics of South America is considerable. The principal articles of trade are cacao, indigo, sugar, timber, mahogany, cedar-wood, tar and pitch, sail-cloth, and hides. Realejo may be considered as the port of the town of Leon, which is only about twelve miles distant, and connected with it by a carriage-road, the whole intervening distance being nearly on a level.

(Juarros, *Statistical and Commercial History of Guatemala*, translated by Baily; and Haefken's *Central America*.)

REALGAR. [ARSENIC.]

REALISTS. [NOMINALISTS.]

REAPING (or cutting the corn when it is ripe) is one of the most important operations of harvest. It requires many hands to accomplish it in proper time, so that the corn which is ready for the sickle may not be too ripe and shed, nor the fair weather be allowed to pass before all the corn is secured in barns or stacks. The labourers who are required all the year for the common purposes of husbandry seldom suffice for the harvest, especially on extensive farms, and recourse is usually had to the assistance of mechanics and artisans from the neighbouring towns and villages where the population is considerable, or labourers are induced by good wages to come from a distance. As the harvest is later in those parts of every country which have a more northern situation, or are higher above the level of the sea, bands of reapers from these come to assist in the harvest of those tracts whose produce is earlier. To encourage the annual return of so desirable assistants, every encouragement is given them, not only by wages, but also by food and drink, and amusements after the toil of the day. Thus the time of harvest is a time of rejoicing both to the labourers and the master.

The common reaping-hook, or sickle, with which the corn is usually cut, is one of the oldest instruments of husbandry; and the goddess Ceres was generally represented by the antients with a sheaf of corn and sickle in her hand. In reaping with the sickle, a portion of the stems is collected with the left hand, and held fast; while the sickle in the right hand is inserted below the left, taking the stems in its semicircular blade, and cutting them through by drawing the sickle so as to act as a saw, for which purpose the edge is finely serrated in a direction from the point to the handle. The heads of the corn, with the upper part of the straw, are then laid on the ground in quantities which may readily be collected into a sheaf. Practice soon gives dexterity to the reaper; and he finds it more expeditious to cut small quantities in succession until he has filled his hand, than to attempt to cut through a large handful at once. Severe wounds are often inflicted on the fingers of the left hand by beginners, even to the loss of a finger; but this soon makes them cautious and expert. The division of labour is introduced with advantage amongst a band of reapers. A certain number cut the corn, while others follow to gather the sheaves; some only preparing the bands, and others tying them and setting up the sheaves into stooks or shocks, which usually consist of ten or twelve sheaves. The smaller the sheaves are, the less injury the corn sustains in a wet harvest; as the moisture in a thick sheaf does not so readily evaporate. Hence it is the interest of the farmer to see that the reapers do not make the sheaves too large. In many places there is a regular measure for the circumference of a sheaf, which should never exceed thirty inches. The bands are made by taking two small handfuls of the cut corn, and crossing them just below the ears into a knot. The sheaf is then pressed with the knee, and the band drawn tightly around it. The ends are twisted together like a rope, and inserted under the band, which effectually fastens it. This operation is soon learnt, and is done very rapidly. The sheaves should be so tied that there may be no danger of their falling loose when pitched into the cart or stacked, without being so tight as to prevent the moisture in the straw from evaporating. They should not be tied too near the ears, but rather nearer to the butt. The sheaves, when tied, are placed two and two on the butt-ends, with the ears leaning against each other: sometimes they are placed in a circle, all the ears being together, and the butts slanting outwards: a sheaf is then opened, by inserting the hand into the middle of the ears, and reversed over the tops of the preceding, forming a cone, and covering all the other ears, while it hangs down around them. In this position they will bear much rain without injury. It is a good practice to place the shocks across the furrows between the stitches or lands, so as to allow the air to circulate more freely around them. In this case four or five sheaves are placed in a row, leaning against as many in a parallel row; and two sheaves, being opened, are reversed over them to protect the ears. Whatever be the mode adopted in reaping the corn, the same kind of sheaves are formed, and set up in shocks.

Wherever the sickle is used for reaping, the straw is cut at a certain height from the ground, and the remainder forms a long stubble, which is usually mown at leisure after harvest, and carried into the yard for litter; but in the neighbourhood of large towns, where straw is sold at a good price, or exchanged for stable dung, it is important that as much as possible of it should be cut with the corn. This has introduced the practice called fagging, and sometimes bagging, the origin of which provincial expressions is not well known. The instrument used for this purpose partakes of the nature of a scythe, as well as of a reaping-hook. It is shaped like a sickle, but is much larger and broader; and instead of being indented like a saw, it has a sharp edge like a scythe, which is renewed when blunt by means of a stone or bat. The fagging-hook cuts the straw close to the ground by a stroke of the hand; and its curved form is only useful in collecting stray stems, and holding a certain quantity of them between it and the left hand of the reaper when he makes up a sheaf. A certain quantity is cut towards the the standing corn, the left hand pressing it down at the same time. When as much is thus cut as would make half a small sheaf, the reaper comes backwards, cutting in a direction at right angles to the first, and rolling together the two parts, which he carries in the bend of his hook and places on the band which has been prepared for him. A full-sized sheaf is usually composed of two cuttings. Two men will fully employ a third to make bands for them, tie up the sheaves, and set them up. This method of reaping is laborious, on account of the stooping required to cut near the ground. The Hainault scythe, which has been described in most agricultural works, does the work better, and with less fatigue. It is in fact a fagging-hook, not quite so curved, of which the handle is longer, and placed at an angle with the plane of the blade. It requires some practice to give the proper swing to it by a peculiar motion of the wrist; but when this is once acquired, a considerable saving of labour and time is effected. Many attempts have been made to bring it into use in England; but, from the obstinacy of the labourers, or the want of perseverance in the masters, without much success. A better instrument however on extensive farms is the cradle-scythe, which, in the hands of an expert mower, will do more work and more effectually secure all the straw than any other instrument.

The objection to the great barn-room required for so much straw is obviated by the practice of stacking the corn in the open air on proper stands to keep it dry and out of the reach of vermin. The additional trouble in threshing is not so great as that of mowing or raking the stubble, which is generally deferred till half of it is lost by decomposition by the air and moisture. The advantage of mowing extensive crops is clearly shown in a paper in the fourth number of the 'Journal of the Royal Agricultural Society of England,' by Mr. Rodwell of Alderton Hall, Suffolk, who has found by experience that the crop of wheat which was mown by the scythe and tied up in sheaves was fully as soon fit to be carried as that which had been reaped. When the saving of time is considered as well as the saving of expense, there seems to be no doubt that on an extensive farm the scythe is far preferable to the sickle for cutting every kind of grain. Barley and oats are usually mown and carried without tying them into sheaves, but this is a slovenly and wasteful practice: by means of the cradle-scythe they may be mown so regularly as to be readily tied into sheaves; and the additional expense will be fully compensated by the saving of all the corn which, being on the outside of the stack, is lost by the depredations of small birds.

Beans are usually reaped by the sickle, the stems being too strong and too wide apart to admit of the scythe. Where it can be done conveniently, without the soil adhering too much to the roots, it is better to pull them up, and tie them in bundles with straw bands, or tar-twine, which will be found both a convenient and economical method.

Peas are generally reaped by means of two large hooks similar to the fagging-hooks, one of which is held in each hand; and the stems, which are generally much interwoven, are partly cut and partly torn from the roots, and so rolled up into a small bundle laid loose in order that it may dry. Tares are reaped in the same way.

The expense of reaping corn is considerable, especially where the population is scanty. In the eastern counties men are engaged for the whole harvest, which, in favourable weather, is supposed to be completed in a month. During this time they have their usual daily wages, with or without food, and a certain sum besides, as harvest money. In other districts the labourers reap the corn by the acre, with a certain allowance of beer, or money instead of it. The price of fagging in Middlesex and within 30 miles around London varies from nine to twelve shillings per acre, according to the crop, and if it is lodged, as much as fifteen shillings is often paid, including beer. The use of the scythe considerably diminishes the expense, as fewer labourers are required.

There have been many attempts to introduce machinery for reaping corn. Some of the inventions were ingenious and promised well. but none, when put to the test, answered the expectations formed. The various inclinations of the straws prevent any regular mode of cutting. A patent is at this moment obtained for an invention for reaping corn and mowing grass, of which the particulars have not yet been published: whether it will be more successful than its predecessors remains to be proved. The principle of most reaping-machines, is that of a revolving edge to cut the straw, and a drum to lay the cut corn down regularly. Wherever the corn is laid or lodged, it is evident that no machine can collect straws lying in every imaginable direction and interwoven with each other. Till some better invention appears, the scythe will probably be found the cheapest and most expeditious instrument for reaping the corn. [HARVEST.]

REASON, according to the common notion, is the highest faculty of the human mind, by which man is distinguished from brutes, and which enables him to contemplate things spiritual as well as material, to weigh all that can be said or thought for and against them, and hence to draw conclusions, and to act accordingly. A man may therefore be said to possess reason in proportion as he actually exercises that power, that is, reasons and acts according to the conclusions or results at which he has arrived. In such expressions as 'We have reason to believe such an account,' or 'He has no reason to be dissatisfied,' the word 'reason' does not signify the mental power itself, but the conclusion or result of the process of reasoning, in contradistinction to motives, which are never the results of mental operations, but merely outward circumstances by which our actions are influenced.

Thus far reason is of a purely practical nature, and Kant therefore divided reason (if we may venture to translate his word *Vernunft* by the English word *reason*) into practical and theoretical. The latter, which is also called pure, ideal, or transcendental reason, is, according to him, the mind's power of producing ideas *à priori* from its own resources, or the power of conceiving things and their attributes which lie beyond the sphere of our experience, such as infinity, the absolute, God, the supreme good, &c. How far our knowledge of these things can extend is shown in the work of Kant, entitled 'Kritik der reinen Vernunft,' or 'Criticism of Pure Reason.' Reason, in its practical acceptation, forms ideas *à posteriori*, in as far as it derives them from a consideration and comparison of the phenomena of the external world, endeavours to discover unity in variety, and traces all phenomena to one source, a supreme reason, of which human reason is only a reflex.

Schelling defines reason to be the identity of the subjective and the objective, that is, the identity of the power which knows and that which it knows, which includes the knowledge of this identity. As the original identity, says he, exists in God, or is God, reason is a direct knowledge or an intellectual perception of God, of whom no indirect knowledge is possible. Hence God and reason are essentially of the same nature; they are identical: God is in reason, and reason is in God.

(G. M. Klein, *Beiträge zum Studium der Philosophie als Wissenschaft des All.*, p. 218, &c. There are some good remarks on this subject in S. T. Coleridge's *Aids to Reflection*, p. 157, &c.)

RE'AUMUR, RENE'-ANTOINE FERCHAULT DE, was born at Rochelle in 1683. He was brought up to the law, but being much attached to scientific pursuits, and possessing an independent fortune, he gave up his profession and went to Paris in 1703, where he determined to devote his life to his favourite studies. In 1708 he read some geometrical observations before the Academy of Sciences, which were so well received that he was admitted a member at the age of 24. He belonged to that learned body for fifty years, and contributed a vast number of interesting papers to their Memoirs.

The chief objects of his attention were the improvement of the arts and manufactures of his country, and natural history. In 1711 he made some experiments relative to the manufacture of cordage, and he proved that the strength of a cord is less than the sum of the strengths of the threads of which it consists; whence it follows that the less a rope is twisted, the stronger it is. In 1715, while examining the process of colouring artificial pearls, he discovered the nature of the singular substance which gives the brilliancy to the scales of fishes, and he investigated the mode of formation and growth of these scales. He also made some researches of a similar kind on the development of the shells of testaceous animals. When describing, in 1715, the turquoise-mines which he discovered in Languedoc, and the means which are employed to colour these stones, he found that the substances of which these gems consist are portions of the fossil teeth of an extinct animal since named the mastodon.

The most important of Réaumur's labours in the department of the arts were the experiments which he made on the manufacture of iron and steel. He published his researches on this subject in a separate work (those which we have before mentioned appeared in the Memoirs of the Academy), entitled 'Traité sur l'Art de convertir le Fer en Acier, et d'adoucir le Fer Fondu.' He here described the process of making steel, which was then unknown in France (that metal being solely obtained from abroad), and he made his discovery public, for which national benefit the Regent duke of Orleans settled on him a pension of 12,000 livres. He also discovered the art of tinning iron, which was likewise unknown in France. During his experiments on metals Réaumur first observed that these substances in passing from a fluid into a solid state have a tendency to assume certain definite crystalline forms. Among his other useful labours he greatly improved the manufacture of porcelain in France. He also made a number of experiments on artificial incubation, which has been practised from time immemorial in Egypt. He endeavoured to introduce the art into common use in France, but was not successful, owing principally to the greater coldness of the climate than in Egypt. In 1711 he discovered a species of mollusk from which a purple dye might be prepared analogous to the purple of the antients.

In general physics the name of Réaumur is celebrated from the thermometer which he invented in 1731. He took the freezing and boiling points of water as two fixed points, and then divided the interval into 80 degrees, the freezing point being zero. The centigrade thermometer now in more general use in France was only an improvement on Réaumur's, the interval between the freezing and boiling points being divided into 100 instead of 80 degrees. [THERMOMETER.]

Though many of the researches which we have mentioned (most of which will be found in the Memoirs of the Academy, together with many papers on other subjects by the same author) were very useful and important, yet his labours in the field of natural history were much more novel and interesting. In 1710 he described the means by which many shell-fish, echinodermata (sea-stars), and other mollusks and zoophytes, execute their progressive movements, and in 1712 he [illegible] tion of [illegible]

Of all the [illegible] Cuvier, [illegible] is to be struck with the [illegible] which [illegible] to have just ideas of [illegible] variety of means which she employs [illegible] of her productions, and those which are in appearance the least capable of resistance, [illegible] 'Mémoires pour servir à l'Histoire des Insectes,' of which 6 volumes 4to. appeared between 1734 and 1742. Cuvier adds, 'The author here carries to the highest point his acuteness of observation in the discovery of those instincts, so complicated and so constant in each species, which maintain these feeble creatures. He unceasingly excites our curiosity by new and singular details. His style is a little diffuse, but clear, and the facts which he relates may always be depended on.' While collecting materials for this work we find it recorded that he kept numerous insects of all kinds in his garden, for the purpose of observing their habits and instincts. Unfortunately this work is not finished, and the 7th volume, which came into the hands of the Academy of Sciences after the death of the author, was left in such an imperfect state that it was not capable of publication. The six volumes which were completed include all the winged insects, except the crickets (*gryllus*), grasshoppers, and beetles. The first two volumes comprise the various kinds of caterpillars, with a description of their forms, mode of life, metamorphoses, &c., as well as the different insects which attack them or live parasitically within them. The third volume includes the cloth-moths, aphides, &c. The fourth embrances the gall insects and the various two-winged flies. The fifth contains the history of bees, and Réaumur made many interesting discoveries concerning the habits of these curious insects, which however have been greatly added to since by the labours of Huber and others. The smaller communities of wasps, hornets, &c., together with an account of the different kinds of solitary bees, occupy the sixth and last volume, which is one of the most curious of the whole.

Réaumur formed a large collection of objects of natural history, of which Brisson was the conservator, and the principal materials for that naturalist's works on quadrupeds and birds were collected from it. Many of Buffon's plates were also taken from objects in his museum, which, after his death, went to the 'Cabinet du Roi.' Réaumur passed a quiet retired life, and his private history is unmarked by any important incident. He is said to have died from the effects of a fall which he received while riding in the country. His death took place in October, 1757, in his 75th year. (*Life*, by Cuvier, in *Biog. Univ.*)

REBEC (*Rebec*, Fr.), a musical instrument of the violin kind, which had three strings tuned in fifths, played on by a bow. This, which has long been in disuse, was small in size, something between the modern violin and the dancing-master's *kit*, or pocket-fiddle, and seems to have been the primitive violin. Laborde says that it was the favourite instrument of the minstrels; and the *ribible*, of which Chaucer and Gower speak, is supposed to have been the rebec. It was much used at festive entertainments. Milton, in *L'Allegro*, mentions it as the 'jocund rebec.'

REBELLION. [SOVEREIGNTY.]

REBOLLE'DO, BERNARDINO, COUNT OF, a distinguished Spanish officer and writer, and one of the heroes of the latter period of the thirty years' war in Germany, was born of illustrious parents at Leon, the capital of the province of that name, in 1597. From his early youth he embraced the profession of arms, and joined the Spanish army of Italy, where he so much distinguished himself as to obtain soon after (1622) the command of a galley, with which he assisted in the taking of Port Maurice and the castle of Ventimille from the Genoese. After this he served in the army, and was present at the taking of Nice (1626) and the storming of the fortress of Casal, where he was severely wounded. In 1632 he commanded a considerable body of Spanish infantry in the Low Countries. Having, in 1636, received orders from his government to march to the assistance of the emperor Ferdinand II., who was closely pursued by the Swedes, he succeeded in extricating that monarch from his perilous situation, and was by [illegible] by appointing him his ambassador to the court of Denmark; and rendered [illegible] service to the King of Denmark when Charles Gustavus marched his army across the frozen [illegible] bombarded Copenhagen. Though a zealous Catholic, Rebolledo felt for the royal house of Denmark a kind of personal affection, which he seized every opportunity of manifesting in his writings. He had early evinced some talent for poetry, and his taste for military and political affairs had not prevented him from successfully cultivating literature. He had whilst in Germany composed a sort of didactic poem on the art of war and state policy, entitled 'Selvas Militares y Politicas,' which he afterwards published at Copenhagen in 1652, 16mo. But it was not until his mission to that capital, when he had attained the age of maturity, that Rebolledo found leisure to prosecute with assiduity his poetic studies. He seems to have taken particular interest in the history and geography of Denmark, a compendium of which he put into verse, which was printed at Copenhagen, under the title of 'Selvas Danicas,' 1665, 4to. After a residence of several years at the court of Denmark, Rebolledo was recalled to Madrid, where he was soon after appointed president of the Board of War in the council of Castile. He died in 1676, in the eightieth year of his age. Besides the two above-mentioned works, Rebolledo wrote—1, 'La Constancia victoriosa y Trinos de Jeremias,' Colonia (Copenhagen), 1665, 4to., being a paraphrase of the Book of Job and the Lamentations of Jeremiah; 2, 'Selvas Sagradas,' Ib., 1657, and Antwerp, 1661, 4to. [These are sundry poems on moral and religious subjects, and chiefly translations of the Psalms, where the author displays some poetic feeling, though much disguised under the pedantic forms of the Gongorine school.]; 3, a play entitled 'Amor despreciando Riesgos' (Love dreads no Danger), possesses considerable interest. Rebolledo was particularly successful as a writer of madrigals, some of which are so good as to remind the reader of the best times of Spanish poetry, which in Rebolledo's time was fast on its decline. His lighter poems appeared at Antwerp, 1660, 16mo., under the title of 'Ocios' (Leisure Hours). An edition of Rebolledo's works was collected in his lifetime, and appeared at Antwerp, 1660, in 3 vols. 4to. But the best and most complete is that of Madrid, 1778, 4 vols. 4to.

REBUTTER. [PLEADING.]

RECAPTION. [REPLEVIN.]

RECAPTURE. [PRIZE.]

RECEIPT is when, in an action between others, a stranger whose rights or interests may be compromised by the result of the suit, prays to be received as a party to it for the purpose of defending them.

This was a remedy partly existing at common law, partly created by statute. The object of it was to prevent the tenant of the freehold, or the termor, &c. respectively, by means of an action collusively brought against him, from defeating the rights of the termor, or the tenant of the freehold, &c. by offering no real defence to the action. In such case the party sought to be thus defrauded was allowed to come and defend his own rights himself. (2 *Inst.*, 233; Com. *Dig.*, tit. 'Receipt.') Something analogous to this has been provided by stat. 11 Geo. II., c. 19, § 11, 12, under which, in case of ejectment against a tenant, the landlord, heir, mortgagee, &c. is allowed to come in and defend in his stead. [EJECTMENT.] In actions of a personal character, by the statute of Interpleader, 1 & 2 Will. IV., c. 58, a defendant who has no interest in the matter for which he is sued, may substitute in his place a third party who claims an interest in it.

In its more general and popular sense receipt means a written discharge of a debtor on the payment of money due. When given for sums greater than five pounds, it must be stamped. The amount of the stamp duty varies with the sums for which it is given, from 3*d*. up to 10*s*. A receipt, though evidence of payment, is not absolute proof, and this evidence may be rebutted by showing that it has been given under mistake, or obtained by fraud. (Impey's *Stamp Act;* stat. 55 Geo. III., c. 184; 3 & 4 Will. IV., c. 23.)

RECEIVER. A Receiver is a person appointed by the Court of Chancery to receive the rents and profits of land, or the produce of other property, which is in dispute in a cause in that court. He is an officer or agent of the court, and as such under its general control.

a suit is pending
nd he can only be
ice has been given

to the proper parties. The motion is generally made after answer; under special circumstances it may be made before answer, but the motion must be supported by sufficient affidavits. The cases in which a receiver is appointed are those in which there is great danger of property being wasted or lost, owing to the want of a proper person to look after it. The following are some instances in which a receiver will be appointed: when an infant is entitled to real estate, especially if it be of considerable magnitude: in suits between partners in trade for the purpose of winding up the concern, when a partner is grossly misconducting himself, disposing of the partnership property, or excluding his copartners from the management of the partnership affairs: when the representation to a person deceased is in dispute in the ecclesiastical courts, and no person has been appointed executor; but if probate has been granted, and there is a suit in the ecclesiatical courts for recalling probate, a receiver will not be granted on that ground only (Watkins *v.* Brent, 1 M. and C., 97): when there is danger of the assets of a testator being lost or wasted through the misconduct of an executor. A manager of West India estates has power to set and let them, and to expend money in repairs; but a receiver has not such power, except as hereafter mentioned.

Certain persons are disqualified from being receivers, such as a solicitor in the cause, the next friend of the infant plaintiff, a peer of the realm, and a receiver-general of a county. The order which is made on motion for the appointment of a receiver, refers it to the master to appoint a proper person, and the master's appointment is conclusive, unless it can be shown to the court that he has appointed an improper person. The receiver must find sufficient sureties, according to the value of the property of which he is appointed receiver; and on the sureties being approved by the master, they and the receiver enter into recognizances before him, and he makes his report of the appointment, which is filed in the report-office.

It is the duty of the receiver, when his appointment is completed, to inform the tenants of the estate in question of his appointment, by the production of the order and the master's report appointing him receiver, that they may pay the rents to him. In every order which directs the appointment of a receiver of landed property, there must be inserted a direction that such receiver shall manage as well as set and let, with the approbation of the master, who is to receive any proposal for the management or letting of the estate from the parties interested, but he must make his report thereon to the court for confirmation in the usual way.

A receiver may distrain for rent, but he must distrain in the name of the person who has the legal estate. If there is a receiver of the rents of an estate under an appointment of the court, an action of ejectment cannot be brought against the tenants in possession, nor against him, if he is actually in possession, without the leave of the court (Angel *v.* Smith, 9 Ve., 335); nor can a receiver defend an ejectment, and charge the expense of the defence in his account, without leave of the court.

A receiver is paid by a per centage on the sum which he receives, usually a shilling in the pound; and sometimes, in the case of large estates, by a fixed salary. But the court, on making an order for a receiver, may refuse to allow a salary; and it often happens that one of the parties in the suit, with the consent of the others, undertakes the office of receiver without a salary. He must annually pass his accounts of receipts and payments before the master, who prepares a report of passing the account, which is filed in the report-office, and does not require confirmation. It is directed in the order or decree for the appointment of a receiver, that the receiver shall from time to time pay the balances which shall be reported due from him into the Bank, with the privity of the accountant-general, to the credit of the cause. A receiver who does not pass his accounts and pay in the balances may be deprived of his salary. (15 Ve., 273.) If he make default in payment of his balances, the recognizances may be put in suit, or an order of the court may be obtained, upon motion and notice to the receiver, that he pay in the balance by a certain day, or stand committed. A receiver of rents and profits has to pass yearly or half-yearly accounts, as the rents and profits are received, and he is chargeable with interest at 5 per cent. on balances in his hands which he neglects to pay at the times fixed for that purpose. A receiver of personal estate retaining balances in his hands will lose his salary but in respect of interest he is only to be charged [illegible] cutor would be, who had received personal estate. ([illegible] Leighton, 6 Ve., 273.)

When the receiver has passed his final account before [illegible] master, procured the master's report thereof, and filed it, and paid the balance into the Bank, or to the person entitled to receive the money, to whom the order directs him to pay it, he may apply by petition to the court for the vacating of the recognizances and his own discharge, and an order will be made accordingly, upon all the facts being proved to the court, which are the foundation of the receiver's right to his discharge.

A receiver is not liable to make good unavoidable losses.

RECEIVER. [Retort.]

RECESS. This word is so familiar as to need no explanation, and it can hardly be classed among architectural terms; but that the subject of recesses should hitherto hardly have been treated of at all by professional writers, is somewhat remarkable, because there is nothing which contributes more to effect, or affords greater scope for design and fresh combinations in interior architecture. We shall here briefly notice the several circumstances which belong to recesses, and which tend to modify their character. Besides those of *plan*, *elevation*, and *section*, there are others, one of which is that of *relative size*, as compared with the rest of the plan. Ordinary shallow recesses—which kind might be distinguished by the name of *blank recesses*, since they are little more than breaks in the wall, and do not at all affect the general plan of a room—hardly belong to the subject, since they admit of scarcely any variety. By recesses we here mean those which come under the denomination of exhedræ, tribunes, alcoves, and afford considerable additional space. In plan these may be either curved or rectilinear, that is, semicircular (like the tribune of a Roman basilica) or segmental; or else polygonal, or rectangular, in which latter case the plan may be either a parallelogram, or so deep as to be a perfect square. Neither are these the only varieties of plan, for in each instance the recess may be either simple or *expanded*, that is, wider within than the breadth of the opening towards the room. If the plan be curved, it is usual to make the elevation in the form of an arch, either plain or decorated; in which latter case, it is sometimes the practice either to continue the archivolt without any impost, or to make it rest upon the entablature or capitals of pilasters. Elevations of this class however are only *astylar*: it is when columns come to be introduced into them, that alcoves admit of so many combinations and so much variety of design. The usual mode indeed is merely to separate the recessed part of the plan from the rest by a single line of columns, or rather, by only two columns, forming a *distyle in antis*,—that number being seldom exceeded; but it is by introducing columns behind and within—by extending the recess either laterally or in its background—by admitting light into it from above—that novel and scenic effects may here be produced almost without number. As regards utility and convenience, it is unnecessary to point out the advantage attending a deep alcove for the side-board in a dining-room, communicating immediately with a staircase for the attendants,—of which kind the tribune in the dining-room at Holkham furnishes one of the earliest and best examples; but alcoves and recesses add also to the commodiousness of other apartments—libraries, drawing-rooms, &c., affording nooks for study, or conversation apart, similarly to the spacious bays and recesses of that kind in Gothic mansions.

RECIPROCAL, a mathematical term mostly applied to the fraction made by inverting another fraction; thus $\frac{3}{2}$ is the reciprocal of $\frac{2}{3}$, and $\frac{1}{7}$ of 7 or $\frac{7}{1}$. The term arises from the common meaning of the adjective reciprocal, and would be properly applied in every case in which A has to B the same sort of relation that B has to A. Custom however confines the absolute use of the term to that above-mentioned. A reciprocal property is one which each of two things has with reference to the other; thus if A and B be what are called conjugate diameters of a conic section, the tangent at either extremity of A is parallel to B, and that at either extremity of B is parallel to A. Hence these lines are reciprocally connected with each other, and are therefore called conjugate; for the word conjugate, which denotes joined, generally means joined by a reciprocal property.

RECITATIVE (*Recitativo*, It.), language delivered in musical tones, that is, in the sounds of the musical scale.

It differs [illegible] the length [illegible] gulates them [illegible] and expression [illegible] governed by any principal of [illegible] its final cadence or close must be in some [illegible] key of the air which follows, or, at least, in no very [illegible] key. Recitative is of two kinds—*Unaccompanied* and *Accompanied*. The first is when a few occasional chords are struck by the piano-forte, or by a violoncello, to give the singer the pitch, and intimate to him the harmony. The second is when all, or a considerable portion, of the instruments in the orchestra accompany the singer, either in sustained chords or in florid passages, as the composer may deem expedient, in order to give the true expression or colouring to the passion or sentiment to be expressed. Perhaps the Italian definition of Recitative, *musica parlante*—speaking music—is the best, as it certainly is the most concise, that can be offered.

There can be no doubt that the language of the antient drama, both Greek and Roman, was delivered in a kind of recitative. [MUSIC; OPERA.]

RECKONING AT SEA is the process of computing the several elements which relate to the determination of the ship's place at any time. The term may include the operations which are performed in finding the latitude and longitude of the ship, the variation of the needle, &c., from celestial observations; and the part which is independent of these is called the *dead-reckoning*. It is this last only which we purpose here to explain.

When a ship crosses the seas towards the place of its destination, its path, on account of the various winds, currents, &c. by which it is impelled, is always indirect, and generally consists of numerous zig-zags, whose portions are lines of a few miles in length. The length of each of these lines, and the angle which it makes with the terrestrial meridian passing through one of its extremities (all necessary corrections having been made) are the data obtained by the *log-line* and *compass;* and the earth being supposed to be a sphere, those lines might be considered as arcs of great circles. Hence the rules of spherical trigonometry might be employed to find the length of an arc joining the two extremities of the series of indirect lines, and the angle which it makes with the meridian passing through either of those extremities; and, from these, the geographical position of the ship. But, because this process is considered laborious, others possessing greater facilities are, according to circumstances, employed, and these will be described after it has been shown what are the corrections which the observed elements require before they can be used in the computations.

The reckoning may be said to commence when the ship is on the point of quitting a harbour or road; and the first circumstances to be recorded are the observed bearing and the estimated distance of some remarkable object on the coast whose geographical position is known, together with the bearing of the ship's line of motion at the time, and her velocity on that line.

Let it be here observed that the said object on the coast is called the point of *departure*, and that the angle which the line of a ship's motion at any time makes with the meridian passing through the actual position of the ship is called her *course*. Now, while the angle indicated by the compass remains the same, the ship's path, except when it coincides with the meridian, or with a line tending due east and west, is a portion of that which is called the *loxodromic curve* [RHUMB-LINE]; yet, to the extent of a few miles, it is the custom to consider it as a right line, and, therefore, as making a constant angle with the meridian passing through one of its extremities. The deviation of the magnetic from the true meridian (the declination or variation of the needle) differing in different places, the amount of that variation [illegible] celestial observations as often as possible, must be added to or subtracted from the angles observed with the compass, in order to have the bearings or course from the true meridian. But while a ship is sailing with the wind in a direction oblique to the line of her keel, she is compelled, by the force of the wind and the resistance of the water against her side, to move in the direction of a line which makes some angle with her keel on the side opposite to that from which the wind is blowing; this angle is called the *lee-way*, and as it differs for different ships, it must always be determined by trial in some one of the ways proposed in treatises on navigation. The estimated amount of the lee-way is a second correction, which must be applied to the course observed with the compass, in order to obtain the correct angle with the meridian.

The velocity of the ship is ascertained by means of the log-line [LOG-LINE], which at once indicates the number of geographical miles (equatorial minutes) she has passed over in an hour; and consequently, supposing her motion to be uniform, the space through which the ship has sailed on a particular course in a given number of hours is known. This is technically called the *distance*.

Again, when a ship is sailing either in a current of the ocean, or in a tide near a shore, her velocity and the direction of her motion will be affected by those of the current or tide. First, if the ship is impelled by the wind in the same direction as the current is moving, it is evident that the velocity given by the log will be only the difference between the ship's real velocity and that of the current, and consequently the latter must be added to the velocity given by the log in order to have the true velocity. On the other hand, if the ship is impelled by the wind in a direction contrary to that of the current, the velocity of the latter must be subtracted from that given by the log, in order to obtain the true velocity of the ship. Again, if the direction of the current is oblique to the line of the ship's motion according to the compass, the true path and velocity of the ship will, by the *composition of motions*, be the diagonal of a parallelogram formed on lines representing the observed directions and velocities of the ship and current; consequently, since this rule is the same as that by which is found a path of the ship which shall be equivalent in length and direction to any two successive paths whose lengths and directions are given, it is evident that among the registered courses and velocities of a ship it will be only necessary to insert the observed direction and velocity of the current, as if the ship had actually moved in that direction, and with that velocity during the time that she continued to sail in the current. The like remark may be made respecting the deviation of a ship from the course on which she appears by the compass to have sailed, in consequence of a swell of the sea, by which she may be driven in some other direction. This direction must be observed, and the velocity estimated according to the judgment of the seaman.

Now, in order to show how all the corrections may be applied to the observed elements, let it be supposed that at the noon of some day a remarkable object A on the shore was observed by the compass to bear W. by N., and that its estimated distance from the ship was 20 miles. At the same moment let the ship begin to sail on a course which is S.W. by the compass; and let the velocity by the log be 3 knots, or 3 miles per hour. Also let the following table express the several memoranda in the order in which they may be supposed to have been made in the course of one day; that is, according to the practice of seamen, between the noon of one day and the noon of the next.

The bearing of the ship from the point of departure being corrected for the variation of the needle becomes N. 78° 15′ E.; the distance is 20 miles.

The first course corrected in like manner becomes S. 21°

Day of Month.	Hour.	Knots.	Wind.	Course.	Lee-Way.	Remarks.
	Noon.	3	W.N.W.	S.W. (or S. 45° W.)	0.	The point A of departure bore W. by N., distant 20 miles; its lat. ——, and long. ——.
	2 P.M.	4½				
	8	5¼				
	10	6	W. by N.	S.E. by S. (or S. 33° 45′ E.)	¼ E., or 2° 49′ E.	A swell setting towards E.N.E. from 2 P.M. to 8 P.M.: velocity 6 miles per hour.
	12	4½				
	6 A.M.	5¼				
	8	6	W.	S.S.W. (or S. 22° 30′ W.)	1 E., or 11° 15′ E.	A current setting towards S.S.E. from 10 P.M. to 10 A.M.: velocity 2 miles per hour. Variation N. 24° W.
	10	6½				

W.; and the distance run between noon and 10 P.M. is 43·5 miles.

The third course corrected for lee-way and variation becomes S. 60° 34′ E.; and the distance run between 10 P.M. and 8 A.M. is 50·5 miles.

The fourth course corrected in like manner becomes S. 12° 45′ E.; and the distance run between 8 A.M. and noon is 25 miles.

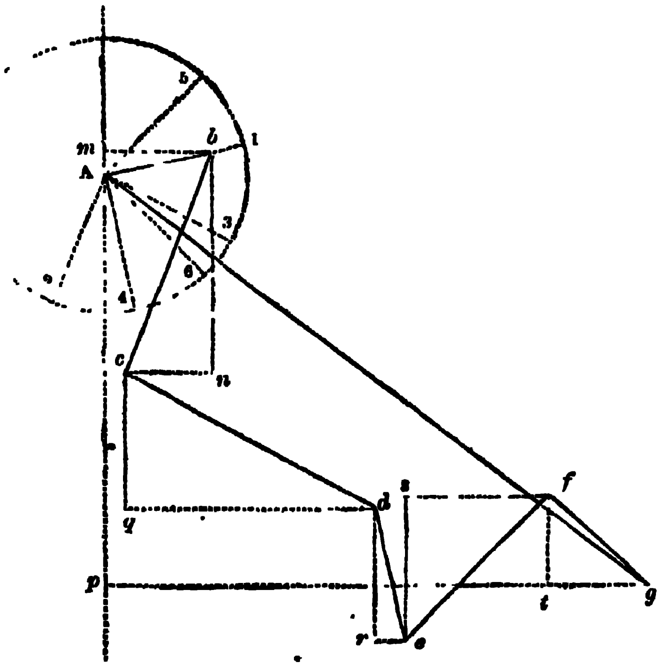
The direction of the swell corrected for the variation of the needle becomes N. 43° 30′ E.; and the distance is 36 miles. Lastly, the direction of the current corrected for the variation becomes S. 46° 30′ E.; and the distance is 24 miles.

These corrected courses and distances are then inserted in order, as in the first and second columns of the following table:—

Courses.	Distances.	N.	S.	E.	W.
N. 78° 15′ E.	20	4·07 (= Am)	. . .	19·58 (= bm)	. . .
S. 21° W.	43·5	. . .	40·7 (= bn)	. . .	15·59 (= cn)
S. 60° 34′ E.	50·5	. . .	24·82 (= cq)	43·98 (= dq)	. . .
S. 12° 45′ E.	25	. . .	24·38 (= dr)	5·52 (= re)	. . .
N. 43° 30′ E.	36	26·11 (= se)	. . .	24·78 (= sf)	. . .
S. 46° 30′ E.	24	. . .	16·52 (= ft)	17·41 (= gt)	. . .

Now, if the navigation is comprehended within about ten degrees on each side of the equator, such a zone of the earth may be supposed to be projected on the interior surface of a circumscribing cylinder, and then developed on a plane; in which state the meridians and the parallels of latitude become right lines parallel to themselves respectively, and the length of a degree of longitude on every parallel equal to that of a degree on the equator or on the meridians. This is called the *plane chart*, and the projection of a ship's path on it is called *plane sailing*.

Let the several directions in which the ship has moved, and the distances passed over in each direction, be represented in the subjoined diagram, the construction of which, agreeably to the nature of the plane chart, is as follows:—



Draw the lines A 1, A 2, A 3, &c., making with Ap, the meridian of the point of departure, angles equal to the several courses as they occur successively in the preceding table (col. 1), and draw the lines bc, cd, &c. parallel to A2, A3, &c. respectively; the distances Ab, bc, cd, &c. being laid down according to the successive numbers in col. 2 by a scale of equal parts representing geographical miles (or equatorial minutes). At the end of the day the ship is arrived at the point g; therefore if A and g be joined, and gp be drawn perpendicularly to Ap, the angle pAg is the resulting course, Ag the resulting distance, Ap the difference of latitude between A and g, and pg is what is called the *departure*, which, in plane sailing, is identical with the difference of longitude between the same points A and g.

By drawing lines perpendicular and parallel to Ap, as in the above diagram, there will be formed the several right-angled plane triangles Abm, bcn, &c., in each of which there are given the hypotenuse and the angles; and consequently by the rules of plane trigonometry the several sides Am, bm, cn, bn, &c. may be computed. Now, let these computed values be placed in the third and succeeding columns of the above table in the following order:—those which are parallel to Ap in the column N. or S., according as the lines which represent them lie towards the north or towards the south of that extremity which is first, in order of sailing, on the corresponding hypotenuse; and those which are perpendicular to Ap in the column E. or W., according as the lines which represent them lie towards the east or west of that same extremity. Then the sum of the numbers in the column N. being subtracted from the sum of those in S. will be found to leave 76·24, and this will be the value of Ap in geographical miles (or equatorial minutes); consequently 1° 16′ 14″ will express the extent in latitude to which, on the whole, the ship has sailed southwards during the day. Again the number in W. being subtracted from the sum of those in E will leave 95·68 (= 1° 35′ 41″), and this will be the value of pg, or the extent in longitude which, on the whole, the ship has sailed eastward during the day. Thus the position of A being known, we have that of g. In the right-angled plane triangle Apg, having Ap and pg in miles, as above, we may compute Ag and the angle pAg, that is, the resulting distance and course. The former will be found to be = 122·35 miles, and the latter S. 51° 27′ E. The series of zig-zag lines which a ship may describe is called a *traverse*; the preceding table is called a *traverse table*, and the whole operation of finding the resulting course and distance is called *traverse sailing*.

In practice, both the construction and calculation above indicated are superseded by the use of the table of *difference of latitude* and *departure*, which is given in treatises on navigation. The numbers in the table are nothing more than the computed values of the sides of right-angled triangles; the hypotenuse, or the distance, and the adjacent angle, or the course, being given. Thus by referring to such a table, the courses and distances being used as arguments, the numbers in the columns N. S. E. W. above, might have been found sufficiently near the truth. And, conversely, seeking in the table the difference of latitude (= 76) and the departure (= 96), the corresponding distance (= 122) would be seen in its proper column, and the angle or course (= 51°) at the bottom of the page.

The logarithmic or Gunter's scale [SCALE] was formerly for the sake of expedition, much used in the resolution both of plane and spherical triangles for the purposes of navigation. If, for example, it were required by that instrument to find the values of cq and qd in the triangle cqd, the following proportions

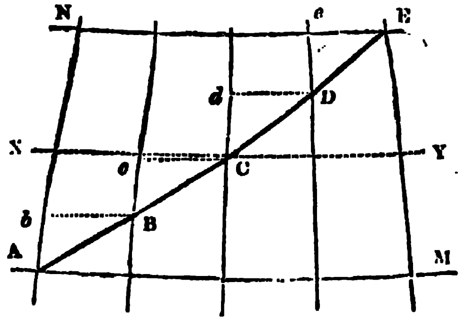
Rad. : sin. qcd (60° 34′) : : cd (50·5) : qd (= 44)
Rad. : sin. cdq (29° 26′) : : cd : cq (= 25)

might be worked by taking in the compasses the distance from 90° to 60° 34′ on the line of sines, and applying that distance on the line of numbers from 50·5 towards zero; the other foot of the compasses would fall on 44, which is the value of qd; again by taking the distance from 90° to 29° 26′ on the line of sines, and applying it on the line of numbers, from 50·5, as before, the other foot of the compasses would fall on 25, which is the value of cq. But it is evident that when the angle is small, or nearly a right angle, the instrument must be very inaccurate.

Should a ship, on any part of the earth's surface, sail for a short time in a direction either due east or due west, so that during that time it might be considered, without sensible error, as sailing on the circumference of a parallel of latitude, the determination of its place is obtained by a different process. Thus, the earth being supposed to be a sphere, the length, in miles, of any arc of the equator between the meridian circles passing through its extremities is to the length, in miles, of the arc between the same meridians on any given parallel of latitude as radius is to the cosine of the latitude of the parallel. Therefore, when the number of geographical miles passed over on any parallel of latitude is known by the log (all due corrections being supposed to be made), the difference of longitude corresponding to that distance may be found at once by the above proportion. Evidently also, if any three whatever of the terms are given, the fourth can be found; and thus every variation of the case may be resolved. This is called *parallel sailing*.

But the tables of difference of latitude and departure may be rendered available for finding the required term if we consider the latitude of the parallel on which the ship is sailing to represent what is called the *course* in those tables; the distance in miles on the parallel as the *difference of latitude*, and the difference of longitude in geographical miles as the *distance* in the tables; and then, by inspection as before, the required term may be found.

The third method of operating, which is called *middle latitude sailing*, has been defined under LONGITUDE AND LATITUDE, METHODS OF FINDING, and we have here only to point out its application. Let AE be a portion of the rhumb-line which a ship describes while her motion continues to coincide with the direction of one point of the compass, that is to say, while it makes a constant angle with the meridians of her successive places. Let this curve be divided into any parts, AB, BC, &c. of small extent, so that each part may, without sensible error, be considered as a straight line; and imagine both meridians and parallels of latitude to be drawn through A, B, C, &c. Then the several triangles BA*b*, CB*c*, &c. being considered as plane triangles, if the constant angle BA*b*, CB*c*, &c. be represented by A, we shall have—



$AB \cos. A = Ab$, $BC \cos. A = Bc$, &c.; also

$AB \sin. A = Bb$, $BC \sin. A = Cc$, &c.; whence, by addition,—

$(AB + BC + \&c.) \cos. A = Ab + Bc + \&c.$, and

$(AB + BC + \&c.) \sin. A = Bb + Cc + \&c.$

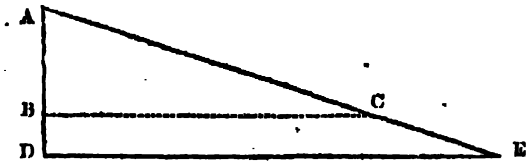
It is evident therefore that the sum of all the distances multiplied by the cosine of the course will be equal to EM, the difference between the latitudes of A and E as in plane sailing; but the sum of all the distances multiplied by the sine of the course (that is, the sum of all the departures, B*b*, C*c*, &c.) will be less than AM and greater than NE. Therefore, as an approximation to the truth, we may consider the sum of all these departures as the length, in miles, of the arc XY (between AN and ME) of a parallel of latitude equally distant from AM and NE; that is, of a parallel whose latitude is an arithmetical mean between the latitudes of A and E. Consequently, as in the theorem for parallel sailing, the difference between the longitudes of A and E will be obtained from the proportion

Cos. *mid. lat.* (= lat. of XY) : Rad. :: (AB + BC + &c.) sin. A : diff. of long.;

and, instead of working the proportion, the tables of difference of latitude and departure may be used as before.

If we imagine the earth's surface to be developed on a plane so that the meridians and parallels of latitude may be respectively parallel to themselves as in the plane chart; and if the lengths of infinitely small portions of the circumference of the equator have to the lengths of corresponding portions of a meridian, in any latitude, the ratio that the radius bears to the secant of that latitude [MERCATOR'S PROJECTION; RHUMB-LINE], there may be formed a species of chart which will afford a general and at the same time a sufficiently easy method of determining the elements relating to a ship's place. This method is called *Mercator's sailing*. In the chart just alluded to, the length of a degree, minute, &c. of longitude, on any parallel of latitude, is constant, being the same as the length on the equator, on account of the parallelism of the meridians; but, in any latitude, the length of a small meridional arc (which, without sensible error, may be of one minute) varying with the secant of the latitude of the arc, the distance, on the map, of any parallel of latitude from the equator will be equal to the sum of the secants of all the minutes in the degrees, &c. expressing the latitude of the parallel. Now, in the tables of *meridional parts* which are given in treatises on navigation, the numbers under the arguments 1 min., 2 min., 3 min., &c. express the values of such sums of secants, the length of an equatorial minute (or geographical mile) being unity. Hence the difference between the numbers, in the table, corresponding to the latitudes of two given points will express the number of such minutes or miles on the map between these points.

By the help of this table a triangle may be always constructed with the data of the problem; and the terms required may be obtained by measurement. In the subjoined figure, let AD be the direction of the meridian passing through the ship at A, and BAC be her course; then,



if AC be made equal to the distance in miles by a scale of equal parts, and BC be drawn perpendicular to AD, AB and BC measured on the same scale will be the difference of latitude and departure as in plane sailing. Now, if AD be made, by the same scale, equal to the difference between the meridional parts which, in the table, correspond to the latitudes of the point A and C, and DE be drawn parallel to BC, DE on the same scale will express, in miles or minutes, the true difference between the longitudes of A and C.

What has been said may serve as an example of the manner of constructing the triangle, when the course, the distance, and the latitudes of the two extremities of the distance-line are given, and it is required to find the difference between the longitudes of those extremities. Again, let the ship's course and distance from any point A, and also the latitude of that point, be given, to find the differences both of longitude and latitude. The formation of the triangle ABC is the same as that just mentioned, and AB being measured on the scale of equal parts is the true difference of latitude (in miles or minutes); this being added to or subtracted from the latitude of A, gives the latitude of C. Then, with these latitudes, find from the table the difference between the meridional parts, and proceed as before to find the difference of longitude. If the latitudes of the ship at two places were given and also the distance between those places, and it were required to find the course and the difference of longitude:—on the meridian line passing through one of the places A, make AB equal to the difference of latitude in miles by the scale of equal parts, and make AD by the same scale equal to the difference between the meridional parts, in the table, corresponding to the latitudes; then draw the indefinite perpendiculars BC and DE, and from A as a centre with a radius equal to the given distance describe an arc intersecting BC in C. Join A and C, and produce the line to E; then ∠BAC will be the course, and DE, measured as before, the difference of longitude.

It is easy to perceive that the table of differences of latitude and departures may be used in Mercator's Sailing in the same way as it would be employed in Plane Sailing, if the meridional difference of the latitudes, from the table of meridional parts, be made to hold the place of the simple difference of latitude. Thus, in the second of the above examples, with the given course and distance, find by inspection in the first-mentioned table the difference of latitude; then, having got by addition or subtraction the latitude of the place at which the ship is arrived, find in the table of meridional parts the numbers corresponding to those latitudes, and take their difference. Lastly with this difference, as a simple difference of latitude, and with the course, find the departure by inspection in the first table; this departure is the required difference of longitude.

When a ship is in a high latitude, it is necessary to determine the difference of longitude, either by middle latitude or by Mercator's sailing, for every particular course on which the ship may have sailed.

The daily differences of latitude and longitude being thus obtained, the seaman knows, within the degree of accuracy of which his data admit, the latitude and longitude of the ship on any day; but it is easy to perceive that the uncertainties respecting the estimates of the distances run, the variations of the needle, the effects produced by currents, &c. must, in time, render the results of the reckoning very erroneous; and therefore it is of the utmost importance to correct them frequently by celestial observations. The determination of the latitude by meridional or other altitudes is easy; and that of the longitude by lunar distances or by chronometers should be made as often as possible. Every geographical position thus determined with precision serves, by comparison with the results of the dead-reckoning, to lead to a knowledge of the causes of the errors which exist in the latter, and becomes a point of departure for the next succeeding portion of the voyage.

RECOGNIZANCE is an obligation of record, entered into before some court of record, or magistrate duly authorized, by which the party entering into it (the cognizor), whose signature is not necessary, acknowledges (recognizes) that he owes a sum of money to the king, or to some private individual, who is called the cognizee. This sum is named the amount of the recognizance. The acknowledgment is generally followed by an undertaking on the part of the cognizor to do some act, such as to keep the peace, to pay a sum of money, to attend to give evidence, &c. On the performance of this act, the cognizor is discharged from his recognizance. On his default, the recognizance is forfeited, and he becomes indebted absolutely to the amount of the recognizance. A debt on recognizance takes precedence of other debts, and binds the lands of the cognizor from the time of its enrolment. If the recognizance is made to a private individual in the nature of a statute staple, &c., he may on its forfeiture, by virtue of process directed to the sheriff, obtain delivery of the lands and goods of the cognizor till the debt is satisfied, or proceed against the cognizor in an action of debt, or by scire facias. If the recognizance is made to the king, it was formerly, in all cases of forfeiture, estreated into the exchequer, and afterwards recovered by process from that court to the use of the treasury. But now, in the cases of forfeited recognizances taken before the court of quarter-sessions, or justices of the peace, provision is made by stats. 3 Geo. IV., c. 46, and 4 Geo. IV., c. 37, for their enrolment among the sessions records, and their immediate recovery by the sheriff. A list of the amounts, &c. is yearly returned by the clerks of the peace and town-clerks for their districts respectively, to the lords of the treasury. A power of appeal by the cognizor against the forfeiture is given to the sessions, and the sheriff is not to levy on the cognizor till the appeal has been decided. Where a recognizance has been estreated into the exchequer, that court may discharge or compound it according to the justice of the case. (Com., *Dig.*, 'Recognizance;' Dalton; 2 Bl. *Com.*; Burn's *Justice*.)

RECONNOISSANCE is an examination of a tract of country or of the sea-coast; the latter previously to a disembarkation of troops, and the former preparatory to the march of an army in order either to meet that of the enemy or to take up quarters for the season.

The *military reconnoissance* of a country is a duty appertaining to the officers on the staff of the quartermaster-general; and if the enemy is in the neighbourhood, it is performed under the protection of an armed force. It is considered as one of the most essential operations connected with the tactics of the field, and serves as the basis of every movement or combination which it may be proposed to make.

A general knowledge of a country which is or may become the seat of war, that is to say, a knowledge of the positions of its fortified places, the directions of its mountains, rivers, and great roads, may be obtained from maps or from geographical descriptions; but that which is necessary for the immediate purposes of a campaign can only be acquired by an actual survey of the ground in detail, and by inquiries made on the spot respecting the means which the country may afford for supplying the wants of the army.

The Maréchal Puysegur (1690) appears to have been the first in modern warfare who regularly performed this duty by examining personally the tract through which the army was to march or in which it was to encamp, and of deciding beforehand on the best routes and positions. He observes (*Art de la Guerre*) that before his time it had been customary to trust, for a knowledge of these points, to the reports of the country-people, or of officers who might accidentally have been on the ground. He adds that disasters frequently occurred by the lines of march being improperly chosen, and that sometimes, after fatiguing marches, and after all the labour of encamping had been undergone, the troops had been compelled to abandon the positions on account of their unfitness. Since that time armies being more numerous and more widely disseminated, consequently requiring more vigilance in the communication of one part with another, and a greater extent of country for their support, the reconnoissances have been made on a greater scale, and in the military establishments of every nation officers are now particularly instructed in all the details of that branch of service.

Those who are charged with this duty should be habituated to the performance of topographical surveys: in the first place by the most accurate methods and with the best instruments; and, secondly, by such methods as admit of being practised rapidly on foot or on horseback. In these cases a compass held in the hand must be used for observing the angles, and the distances must be obtained by pacing, or be merely estimated by the eye. A facility in representing on the plan the inequalities of the ground is also highly necessary.

In making the reconnoissances previously to the march of an army, the whole of the ground between the actual position of the latter and that which is intended to be occupied should be surveyed if the enemy is near and there is danger of his attacking the columns by surprise; otherwise it may be sufficient to survey the ground within a few hundred paces on each side of the roads by which the columns are to march. A complete plan of the tract of country in which the reconnoissance is made may therefore be required; or it may suffice to represent on paper the line or lines of march. In either case, the officer may be provided with a general map, or an itinerary of the intended route as an outline for his guidance; and his survey, when completed, should be accompanied by a report or memoir, stating in detail what cannot be conveniently represented on the plan. In this report should be expressed, with all necessary references to the plan of the ground, the distances, by the different routes, between the two positions, and the places where troops may halt for repose or to form in order of battle; distinguishing particularly the plains where cavalry may act, and the heights on which artillery may be placed. The nature of the roads should be described, with indications denoting that they are passable for artillery, for cavalry, or merely for infantry; and if defective, estimates should be made of the materials and time requisite for repairing them. It is particularly necessary to state whether the ascents and descents are gentle or abrupt; and, when the road is on the side of a hill, whether it is sufficiently level to allow artillery or carriages to pass safely: it should also be noticed whether or not, at places where roads run through towns, they are reduced to narrow and winding streets. The breadths and velocities of rivers, streams, and canals which cross the lines of march should be ascertained, and a statement made whether the beds are rocky, gravelly, or muddy; also whether the banks are high or low. Mention should also be made of the means which exist for passing them; of the places where they are fordable, where there are ferries or bridges, or where boats may be procured; descriptions should also be given of the bridges or boats, and the manner of working the latter. The situations and extent of marshes should also be shown, and it should be stated whether they are passable or can be made so. In contemplating rivers and marshes as means of retarding an advance of the enemy, it should be ascertained and reported whether, by being dry in summer or frozen in winter, they may not at times cease to be obstacles: it should also be stated how, on a retreat, the roads may be blocked up, the fords rendered impassable, or the bridges destroyed.

Should a sufficient number of roads for the different columns not exist, the officer is to ascertain whether or not others may be made by cutting through hedges, walls, or woods, by forming causeways over marshes, or by constructing or repairing bridges over rivers or streams; and also whether the country affords the materials necessary for these purposes. The rates at which it is possible for troops to march in the several roads, defiles, &c. must be estimated according to the breadth of the latter or the degree of their practicability; for on a right estimate of such rate, together with the known length of the road, depend the number of battalions and the class of troops which ought to be appointed to follow each particular route, when it is required that the different columns should arrive at the same time in some given position. The plan should show the situations of farms, mills, houses, &c. which may be capable of being defended or of affording quarters for the troops; and on it should be indicated, by some scale of numbers or otherwise, the relative heights of the ground, that it may be ascertained what positions can be occupied with advantage for offensive or defensive operations. The representation of a simple line of march should also indicate the places where roads diverge from or cross the route, with the distances of the nearest towns or villages from thence; and any particular survey of the ground for an encampment should extend to at least a mile every way beyond the supposed chain of outposts. [MILITARY POSITIONS; PIQUET.] The report must state what are the resources of the country in corn, cattle, and forage; and the number of carriages, horses, and other draught animals that it may furnish for the conveyance of artillery and stores. If the line of march is in the direction of a navigable river which may be available for the last-mentioned purpose, it will be necessary to ascertain its breadth and rapidity, and also the obstructions which may be met with from shallows, weirs, &c. Marshal Suchet caused his artillery to be conveyed by the Ebro from Mequinenza to Xerta, in 1810, preparatory to forming the siege of Tortosa.

An open country presents the greatest facilities for reconnoitring, since the positions of its towns or villages, and the directions of its roads and rivers, can then be easily distinguished and represented on paper. A tract covered with wood is not only surveyed with difficulty, but it imposes on the officer, in addition, the necessity of ascertaining all the directions in which it is capable of being penetrated by the enemy, and in what manner the passes may be blocked up or defended. Open plains intermingled with wood, fields surrounded by hedges, ground intersected by streams of water, ravines, and hollow ways, demand great exactness in the survey, since such tracts afford the most important advantages, both in the higher and in the secondary operations of warfare, to the army which is best acquainted with their details. They allow troops to pass unseen from one point to another when a surprise is attempted or a rapid retreat is to be made; they also afford cover from whence the enemy may be annoyed with little loss. In mountainous districts it is important to ascertain the forms and directions of the chains of heights, with their acclivities on both sides; and, if the line of march is between them, the collateral ravines should be examined to a considerable distance: the commencements and directions of the ravines should also be shown, and all the defiles by which the valleys communicate with each other. Through these defiles troops detached from the army are enabled to fall suddenly on the enemy during his march, to separate his columns, and intercept his supplies or cut off his retreat; and, on the other hand, since the enemy may attempt the like measures, it becomes necessary that the officer employed to reconnoitre should ascertain by what means the passes may be barricaded either to impede the enemy or enable the troops to defend themselves.

In reconnoitring a country, when it is intended to act on the defensive, it should be well known by what roads the enemy can penetrate, and where are the best situations for forming intrenched camps or establishing posts in order to be enabled to keep the field and cover the magazines. Again, if it be intended to carry the war into an enemy's country, it is necessary to discover the position occupied by his army; to find the tract of country most proper for the march, and the spots where the localities permit encampments to be formed with due support on the flanks and security in the rear. If it be intended to besiege a fortress or to attack the enemy's position, the reconnoissance may be made quite up to the glacis of the place, or to the works which protect the position. In the former case it is necessary to ascertain the nature of the fortifications, and the fitness of the ground about them for the operations of the siege; and in the latter, to find out the strength and dispositions of the enemy's troops. An armed force is generally required on these occasions, as, in order to approach near enough for the purpose, it may be necessary to drive in some of the outposts. During the war which ended in 1814, the English and French out-sentries appear to have entertained a mutual understanding not to molest each other, and to retire to their supports before they commenced firing when either army was about to make a movement. Colonel Napier relates that Lord Wellington, being once desirous of reconnoitring the enemy's position at Bayonne, ordered his escort to fire upon some of the enemy who occupied the top of a hill which he wished to ascend; but one of the men going up to the French soldiers and tapping his musket in a particular way, the latter, who understood the signal, quietly withdrew.

In a *maritime reconnnnoissane* the circumstances which it is of most importance to ascertain are: whether the coast is rocky or bordered by downs, and what is the state of the bays or roads with respect to shelter from the prevailing winds; the seasons in which winds blow off and on the shore, and whether the anchorage is secure or otherwise; the nature of the tides, the hours of high and low water, and the depth at either of those times. Precise information should also be obtained of the places at which troops might land, and where there exist rising grounds on which artillery may be disposed to protect them. Rivers should be ascended to a considerable distance if possible, in order to ascertain their depths and the nature of the vessels employed on them by the people of the country. On the other hand, if it were required to examine the coast preparatory to putting it in a state of defence, it would be necessary to find out what points of land are convenient for the situations of forts or batteries by which the enemy may be prevented from landing, and where beacons may be established for the purpose of giving timely alarm. If there are islands on the coast, it would be proper to include them in the survey, since they might be fortified and made to serve as advanced works; and all places should be indicated which are capable of being converted into military posts to prevent the enemy from penetrating into the interior of the country.

RECORD, a memorial in rolls of parchment of the proceedings and acts of a court of law, upon whose proceedings error will lie. An act of a party which is put on record cannot be varied even in the same term, but a judicial act of the court may be altered during the same term. If a record is lost, the court may order a new entry to be made at any time. In order to prove a record the existence of which has not been denied on the pleadings, an examined copy is sufficient.* But if the existence is denied on the pleadings, it can only be proved upon inspection by the court of the record itself; and that is conclusive not only as to the existence of the record, but as to all matters stated in it. For the record of a court of competent jurisdiction is legally considered as the indisputable proof of all those proceedings having taken place which the record sets forth; and no averment to the contrary in pleading can be made. A record found in the proper office is legally assumed to have been always in the same plight in which it is found. The effect of a reversal of a judgment in error is to annul the previous record from the commencement. (*Co. Litt.*, 117 b., 260 a.; Com. *Dig.*, tit. 'Record.') It seems doubtful whether in all cases a record must necessarily be on parchment. (Reg. *v.* Yeovely, 8 A. and E., 806.) As to what constitutes a Court of Record, see COURTS, and RECORDER.

RECORDE, ROBERT, an eminent mathematician of the sixteenth century, was the first native of Great Britain who introduced the study of analytical science into this country. There is no memorial of the exact time of his birth, though it must have been somewhere about the year 1500. We know that he was a native of Tenby in Pembrokeshire, that he entered himself a student at Oxford about the year 1525, where he publicly taught rhetoric, mathematics, music, and anatomy, and that he was elected a fellow of All-Souls College in 1531. Making physic his profession, he repaired to Cambridge, and in 1545 he received the degree of M.D. from that university, and, says Wood, was highly esteemed by all who knew him for his great knowledge in several arts and sciences. He afterwards returned to Oxford, where, as he had done previously to his visit to Cambridge, he publicly taught arithmetic and other branches of the mathematics with great applause. According to Fuller, he was of the Protestant religion. He afterwards repaired to London, at which place he resided in 1547, and in that year published a medical work entitled 'The Urinal of Physic,' which passed through several editions. He was also chosen physician to Queen Mary and Edward VI., to both of whom he dedicates some of his works. With the knowledge of this latter fact, it is scarcely possible to account for the circumstances in which he was at the time of his decease, a prisoner in the King's Bench. He died in the year 1558, probably soon after the date of his will (June 28), in which he styles himself 'Robert Recorde, doctor of physicke, though sicke in body yet whole of mynde.' This document is preserved in the Prerogative Office, and furnishes some facts: to Arthur Hilton, undermarshal of the King's Bench, his wife, and the other officers and prisoners, he gave small sums amounting to 6*l.* 16*s.* 8*d.*; to his servant John, 6*l.*; to his mother, and his father-in-law, her husband, 20*l.*; to Richarde Recorde, his brother, and Robert Recorde, his nephew, his goods and chattels, out of which his debts and the expenses of his funeral were to discharged. This last item leads us to think that debt was not, as commonly stated, the real reason for his imprisonment; although, indeed, the amount of property enumerated does not constitute a large sum even for those days. In a codicil to his will, made on the 29th of June, 1558, he gives directions that his law books should be sold to Nicholas Adams, a fellow-prisoner, for 4*l.*

The works of Recorde are all written in dialogue between master and scholar, in the rude English of the time. They are enumerated by the author himself at the end of his work called 'The Castle of Knowledge;' and there is reason to think that two of his works mentioned in that place are irrecoverably lost, at least no trace of either of them has yet been discovered in print or manuscript. One of them appears to have been entitled 'The Gate of Knowledge,' and the other 'The Treasure of Knowledge.'—Recorde's most popular work appeared as early as 1540, under the title of 'The Grounde of Artes, teachinge the worke and practise of Arithmeticke, both in whole numbers and fractions, after a more easier and exacter sort than any lyke hathe hitherto been set forth.' We have taken this title from the edition of 1573, the earliest we have yet met with. 'The Grounde of Artes' was dedicated to Edward VI., and continued to be repeatedly reprinted until the end of the seventeeth century, the latest edition we have seen being that edited by Edward Hatton in the year 1699. This work contains numeration, addition, subtraction, multiplication, division, reduction, progression, the golden rule, a treatise on reckoning by counters on a principle much resembling that of the Chinese abacus, a system of representing numbers by the hand like the alphabet of the deaf and dumb, a repetition of all the rules for fractions, with the rules of alligation, fellowship, and false position. On the last rule he remarks that he was in the habit of astonishing his friends by proposing difficult questions, and working the true result by taking the chance answers of 'suche children or ydeotes as happened to be in the place.' 'The Pathway to Knowledge,' a brief compendium of geometry, translated and abridged from the Elements of Euclid, was published at London in 1551.

'The Castle of Knowledge' was published in 1556, dedicated in English to Queen Mary, and in Latin to Cardinal Pole. This work is written in the form of a dialogue between master and scholar on astronomy, and from the preface we gather that Recorde had not altogether abandoned astrology. It begins with an account of the Ptolemaic system, and afterwards proceeds in an apparently concealed passage to unfold the elements of the Copernican system of the universe. This passage has already been given in the *Companion to the British Almanac for* 1837, and more latterly in the *Philosophical Magazine*; we do not therefore consider it necessary to repeat it in this place. Recorde appears to have been one of the earliest persons in this country who adopted the Copernican system, if not the earliest person who introduced it among us. All that is cited from Euclid and Proclus is in Greek and Latin, usually both, and Linacre's edition of the latter author is referred to; but the edition of Euclid is not mentioned.

In the 'Whetstone of Witte,' which was published in 1557, Recorde has amassed together the researches of foreign writers on the subject of algebra, then in its infancy, and has also incorporated several improvements of his own. In algebra we recognise Recorde as the inventor of the sign of equality, and of the method of extracting the square root of multinominal algebraic quantities. In perception of general results connected with the fundamental notation of algebra, he shows himself superior to others, and even, we may say, to Vieta, although of course immeasurably below the latter in the invention of means of expression. All his writings considered together, Recorde was an extraordinary genius; and it must be remembered he was a lawyer, a physician, and a Saxonist, as well as the first mathematician of his day.

(Principally taken from a pamphlet by J. O. Halliwell, Esq., on *the Connexion of Wales with the early Science of England*, 8vo., 1840, and from an article in the *Companion to the British Almanac for* 1837, by Prof. De Morgan.)

RECORDER (*Recordator*), a judicial officer, described by Cowell as 'he whom the mayor or other magistrate of any city or town corporate having jurisdiction, or a court of record, within their precincts by the king's grant, doth associate unto him for his better direction in matters of justice and proceedings according to law.' The Norman term, *recordeur*, appears to have originally been applied to every person who was present at a judicial proceeding, and to whose remembrance, or record, of what had taken place the law gave credit in respect of his personal or official weight and dignity. Of this we perceive a trace in the ordinary writ of Accedas ad Curiam, by which the sheriff is commanded to go to some inferior court (which, not being the king's court, is not a court of record), taking with him four knights, and there to record the plaint, which is in that court; the remembrance of the four knightly recordeurs of what they saw existing in the inferior court, in obedience to the king's writ, being treated as equivalent to their actual presence at the proceeding to be recorded. So if the proceedings are in the sheriff's court, he is ordered by the writ of Recordari facias loquelam to cause the plaint to be recorded by four knights. And by a record of the eighth year of King John, we find that a judgment of battle in the court of the archbishop of Canterbury being vouched in the king's courts, four knights were sent to inspect the proceedings, who returned 'quod recordati sunt.' (*Placitorum Abbreviatio*, 54.) The practice of certifying and *recording* the customs of London *by the mouth of the recorder*, which is antecedent to the charters granting or recognising the practice, appears to be referrible to the same source. Where criminal or civil jurisdiction was exercised by citizens or burgesses, it would add to the importance of the court if its proceedings took place in the presence of an officer to whose *record* the superior courts would give credit, either in respect of his personal rank, as a peer or knight, or on account of his connection with those courts, as a serjeant or barrister-at-law. [Serjeant.]

Since 1835 the duties of recorders in the cities and boroughs enumerated in the schedules of the Municipal Corporations Act (5 and 6 Will. IV., c. 76) have been regulated by the provisions of that and of subsequent statutes.

The jurisdiction of the recorder in places of minor importance than those mentioned in the schedules, being taken away, will not require to be noticed. Nor do these acts affect the city of London.

I. The recorder of London is a judge having criminal and civil jurisdiction. He is also the adviser and the advocate of the corporation. In respect of the duties performed by the recorder in the assemblies of the corporation, in the courts of mayor and aldermen, of common council, and of common hall, his office may be said to be ministerial. He is by charter a justice of the peace within the city of London, and a justice of oyer and terminer, and a justice of the peace, in the borough of Southwark.

The first charter of Edward IV. to the city of London grants that the customs of the city be certified and *recorded* by word of mouth, and that the mayor and aldermen of the city and their successors do declare by the recorder whether the thing under dispute be a custom or not.

The business of the mayor's court, in which the recorder ordinarily presides alone, comprehends a court of equity. In the mayor's court the recorder tries civil causes, both according to the ordinary course of common law and the peculiar customs of the city. The amount for which such actions may be brought is unlimited. In London, causes depending in the superior courts at Westminster for sums under 20*l.*, writs of trial are occasionally ordered to be executed by a judge of a court of record in London under statute 3 and 4 Will. IV., c. 42, s. 17. Such trials sometimes take place before the recorder, and sometimes before the judges of the sheriffs' court.

Cases of felony and misdemeanour, and appeals against poor-rates and convictions, arising in the borough of Southwark, are tried before the recorder at the quarter-sessions held for that borough. All the duties of a justice of the peace, including those of chairman, devolve upon the recorder at the quarter and other sessions held at Guildhall for the city of London. At the eight sessions which are held in the year at Justice-hall in the Old Bailey for the metropolitan district, the recorder acts as one of the judges under her majesty's commission of oyer and terminer, and general gaol delivery. At the conclusion of each session he prepares a report of every felon capitally convicted within the metropolitan district, for the information and consideration of the queen in council, and he issues his warrant for the reprieve or the execution of the criminals whose cases have been reported.

The fixed annual salary of the recorder is 1500*l.* The Common Council have added 1000*l.* annually to the salary of the present recorder, and to that of his immediate two predecessors. Besides this, the recorder has fees on all cases and briefs which come to him from the corporation. He is also allowed to continue his private practice.

The recorder is elected by the court of aldermen, most commonly at a special court held for the purpose. Any alderman may put any freeman of the city in nomination as a candidate for the office, but an actual contest seldom takes place. The recorder elect is admitted and sworn in before the court of aldermen. The appointment is during good behaviour, that is, in contemplation of law, for life. The recorder has always been a serjeant-at-law or a barrister. The office has been held by men of considerable eminence: of eleven persons who filled the situation during the last century, one became lord chancellor; another, master of the rolls; another, chief justice of the Common Pleas; and two, barons of the Exchequer. Latterly however, as the duties of the office have occupied a large portion of the recorder's time, counsel in extensive practice have not been desirous of the situation.

By an order made by the court of aldermen in the reign of Philip and Mary, the recorder, common-serjeant, and under-sheriff were directed to be chosen 'from old and learned officers of the city or out of the number of the six learned counsellors,' that number comprehending, in addition to the ordinary city counsel, the attorney and solicitor-general, who were always retained for the city. Three persons by whom the recordership of London has been held during the present century, have previously filled the office of common-serjeant. [Serjeant.] But no similar instance occurred during the eighteenth century.

The recorder of London deriving his authority from charters, and not being appointed by commission (except temporarily as included with other judges in the commission of oyer and terminer, &c. at the Old Bailey), he is not, like the judges of the superior courts, liable to dismissal by the crown upon an address by both Houses of Parliament. But all recorders may be removed for incapacity or misconduct by a proceeding at common law.

Deputy recorders have in some instances, but not very lately, been appointed by the court of aldermen on the nomination of the recorder. (*Report on Municipal Corporations.*)

II. In cities and boroughs within the Municipal Corporations Act, the recorder (who must be a barrister of not less than five years' standing) is a judicial officer appointed under the sign manual by the crown during good behaviour, having criminal and civil jurisdiction within the city or borough, with precedence next to the mayor.

Criminal jurisdiction is given to recorders by the Municipal Corporations Act, explained by subsequent statute. The 105th section of that Act provides that the recorder shall hold once in every quarter of a year, or at such other and more frequent times as he shall in his discretion think fit, or as the crown shall think fit to direct, a court of quarter-session of the peace, at which the recorder shall sit as the sole judge, and such court shall be a court of record, and shall have cognizance of all crimes, offences, and matters whatever cognisable by any court of quarter-session of the peace for counties in England, provided nevertheless that no recorder shall have power to make or levy any rate in the nature of a county-rate, or to grant licence to keep an alehouse or victualling-house, to sell exciseable liquors, or to exercise any of the powers by that act specially vested in the town council.

The jurisdiction of the county sessions extends, under 34 Edw. III., c. 1, to the trying and determining of all felonies and misdemeanours. The commission under which county justices are appointed however directs that if any case of difficulty arise, they shall not proceed to judgment but in the presence of one of the justices of the courts of King's Bench or Common Pleas, or of one of the justices of assize; and courts of quarter-session in counties have latterly treated every case in which judgment of death would be pronounced upon conviction, as a case of difficulty, and have left such cases to be tried at the assizes; and though no such direction is contained in the grant of the office of recorder or in the Municipal Corporations Act, it has been the invariable practice of recorders appointed under the Act to refrain from the exercise of jurisdiction in such cases. [Sessions.]

In the session of 1839 a bill was introduced into the House of Commons for confining the jurisdiction of courts of quarter-session, both for counties and for boroughs, to certain minor offences,—but the bill did not pass.

The civil jurisdiction given to recorders by 5 and 6 Wm. IV., c. 76, § 118, is to try actions of assumpsit, covenant, or debt, whether by specialty or by simple contract, and all actions of trespass or trover for taking goods or chattels, provided the sum or damages sought to be recovered do not exceed 20*l.*, and all actions of ejectment between landlord and tenant wherein the annual rent of the premises does not exceed 20*l.*, and upon which no fine has been reserved, with an exception of actions in which title to land, or to any tithe, toll, market, fair, or other franchise is in question in courts, which before the passing of the Act had not authority to try actions in which such titles were in question. This enactment does not take away the more extended civil jurisdiction which previously existed in particular cities and boroughs by prescription or by charter.

The practice, or mode of proceeding, and also the course of pleading, in courts of civil jurisdiction in cities and boroughs is governed by rules made by the recorder and allowed by three judges of the superior courts.

RECORDER, a musical instrument formerly in use; 'a flageolet or small English flute, the mouthpiece of which, at the upper extremity of the instrument, resembled the beak of a bird; hence the larger flutes so formed were called *flutes à bec.* The recorder was soft in tone, and an octave higher than the flute. Milton speaks (*Par. Lost*, i. 550) of

> "The Dorian mood
> Of flutes and *soft recorders.*"

It would appear, from Bacon's *Sylva Sylvarum*, cent. iii., 221, that this instrument was larger in the lower than in the upper part; and a wood-cut of the flageolet in Mersenne's *Harmonie Universelle* leads to the same conclusion. On the etymology of the word much ingenuity has been bestowed, but without any satisfactory result.' (*Note in Pict. Shaksp.*, 'Hamlet,' Act iii., Sc. 2.)

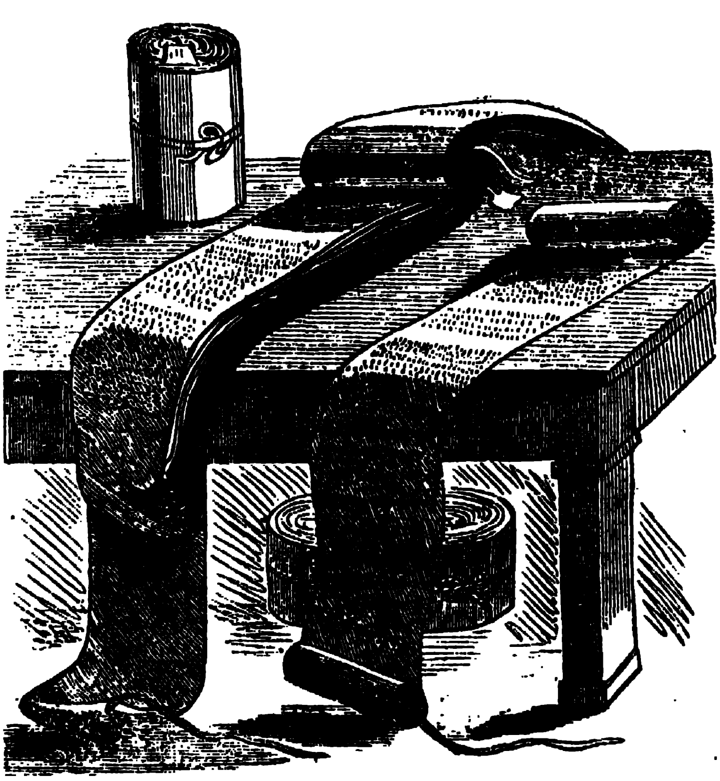
RECORDS, PUBLIC. Authentic memorials of all kinds, as well public as private, may be considered in one sense as records. Thus the Metopes of the Parthenon are indisputable records of Grecian art; the journal stamp on a letter is a record that it has passed through the post-office; a merchant's ledger is a record of his business; and every lord of a manor may keep written records of his courts, as the chancery, the exchequer, and other courts do of their proceedings. But our present purpose is to give some general account of the public records, properly so called, understanding by the term the contents of our public record offices.

Records, in the legal sense of the term, are contemporaneous statements of the proceedings in those higher courts of law which are distinguished as courts of record, written upon rolls of parchment. (Britton, c. 27.) Matters enrolled amongst the proceedings of a court, but not connected with those proceedings, as deeds enrolled, &c., are not records, though they are sometimes in a loose sense said to be 'things recorded.' (2 Sell., *Abr.*, 421.) In a popular sense the term is applied to all public documents preserved in a recognised repository; and as such documents cannot conveniently be removed, or may be wanted in several places at the same time, the courts of law receive in evidence examined copies of the contents of public documents so preserved, as well as of real records. [Courts; Record; Recorder.]

The course we propose to take, is to treat that as a record which is thus received in the courts of justice. The act, for instance, which abolished Henry VIII.'s court of augmentation (of the revenues obtained from the suppression of the religious houses), declared that its records, rolls, books, papers, and documents, should thenceforth be held to be records of the court of exchequer; and accordingly we have seen many a document, originally a mere private memorandum, elevated to the dignity of a public record, on the sole ground of its official custody, and received in evidence as a record of the Augmentation-office. On the other hand, numbers of documents which were originally compiled as public records, having strayed from their legal repository to the British Museum, have thereby lost their character of authenticity. (*Proceedings of the Privy Council*, vol. v., p. 4, edited by Sir Harris Nicolas.)

'Our stores of public records,' says Bishop Nicolson, and, we believe, with perfect accuracy, 'are justly reckoned to excel in age, beauty, correctness, and authority, whatever the choicest archives abroad can boast of the like sort.' (Preface to the *English Historical Library*.) Yet rich as our own country is beyond all others of modern Europe in the possession of antient written memorials of all branches of its government, constitutional, judicial, parliamentary, and fiscal, memorials authenticated by all the solemn sanctions of authority, telling truly though incidentally the history of our progress as a people, and handed down in unbroken series through the period of nearly seven centuries—the subject of its public records now appears, we believe, for the first time in a work like the present. The amount of public care given to this subject during the last forty years, is shown by the appointment of successive commissions and parliamentary committees of inquiry, by a cost in one shape or another amounting to little less than a million of pounds sterling, and by the passing of an act of parliament designed to effect a thorough change in the system of keeping and using the public records.

By far the greater part of records are kept as rolls written on skins of parchment and vellum, averaging from nine to fourteen inches wide,* and about three feet in length. Two modes of fastening the skins or membranes were employed, that of attaching all the tops of the membranes together bookwise, as is employed in the exchequer and courts of common law, whilst that of sewing each membrane consecutively, like the rolls of the Jews, was adopted in the chancery and wardrobe.



The solution of the reasons for employing two different modes has been thought difficult by writers on the subject. It appears to have been simply a matter of convenience in both cases. The difference in the circumstances under which these rolls were formed, accounts, we think, satisfactorily for the variation of make. In the first case, each inrolment was often begun at one time and completed at another. Space for the completion of the entry must have been left at hazard. Besides several scribes were certainly engaged in inrolling the proceedings of the courts, and the roll was liable to be unbound, and to receive additional membranes after it had once been made up. In the other case, the business of the chancery being simply registration, the scribe could register the documents before him, with certainty that nothing in future would at all affect their length, and he was enabled to fill every membrane, and perfect the roll as he proceeded.

In the *volumina*, or *scapi*, of the antients, the writing was carried in equal columns, as in the pages of a book, along the length of the skin, whilst the inrolment in both sorts of our rolls was written across the width of the membrane. Both these kinds of rolls are still used. The rolls of the common law, after the time of Henry VIII., contain so many skins that they cease to be rolls, but become simply oblong books, and, unlike the early rolls of the same series, are exceedingly ill adapted for preservation and inconvenient for use. There are many of these miscalled rolls of the reign of Charles II., which in shape, size, and weight resemble the largest of Cheshire cheeses, often requiring two men to lift them from the rack. Membranes may be fastened together after the chancery fashion in any numbers, and yet remain a legitimate roll, though imposing much bodily labour in the consultation. The land-tax commissioners' Act of 1 Geo. IV. extends, it is said, 900 feet when unrolled, and employs a man three hours to unroll the volume. Other records have the shape of books. Doomsday Book, called both 'Rotulus' and 'Liber,' the oldest and most precious of our records, counting eight centuries as its age, and still in the finest order, is a book; and as occasions presented themselves for adopting this shape without infringing on antient precedent, the far more accessible shape which we now call a 'book' seems to have been employed. A considerable part of the records of the courts of surveyor-general and augmentations, in the reign of Hen. VIII., of wards and liveries, and requests, are made up as books. Other documents, those relating to Fines, the 'Pedes Finium or Finales Concordiæ,' the writs of 'Dedimus Potestatem,' and acknowledgments and certificates, writs of the several courts and returns, writs of summons and returns to parliament, inquisitiones post mortem, &c. &c., by tens and hundreds of thousands are filed, that is, each document is pierced through with a string or gut, and thus fastened together in a bundle.

The material on which the record is written is generally parchment, which, until the reign of Elizabeth, is extremely clear and well prepared. From that period until the present, the parchment gradually deteriorates, and the worst specimens are furnished in the reigns of George IV. and William IV. The earliest record written on paper, known to the writer, is of the time of Edward II. It is one of a series entitled 'Papirus magistri Johannis Guicardi contra-rotulatoris Magnæ Costumæ in Castro Burdegaliæ, anno domini M°. ccc°. viii°.' These records are in the office of the queen's remembrancer of the exchequer.

Tallies were records of wood. [TALLY.]

The handwriting of the courts, commonly called court-hand, which had reached its perfection about the reign of our second Edward, differs materially from that employed in chartularies and monastic writings. As printing extended, it relaxed into all the opposites of uniformity, clearness, legibility, and beauty which it once possessed. The ink too lost its antient indelibility; and, like the parchment, both handwriting and ink are the lowest in character in the latest times: with equal care, venerable Doomsday will outlive its degenerate descendants.

All the great series of our records, except those of parliament, are written in Latin, the spelling of which is much abbreviated, and in contractions, there can be little doubt, derived from Latin manuscripts. The reader who desires to be further informed on the subject may consult the collection which Mr. Hardy has inserted in the preface to his 'Close Rolls of King John,' and Mr. Hunter, in his preface to the 'Fines of Richard I. and John.' During the Commonwealth, English was substituted; but soon after the Restoration, Latin was restored, and the records of the courts continued to be kept in Latin until abolished by act of parliament in the reign of George II. In certain branches of the Exchequer, Latin continued in use until the abolition of the offices in very recent times. Many of our statutes from Edward I. to Henry V., and the principal part of the rolls of parliament, are written in Norman French. Petitions to parliament continued to be presented in Norman French until the reign of Richard II., whose renunciation of the crown is said to have been read before the estates of the realm at Westminster first in Latin and then in English. After this period we find English, which had doubtless always remained in use among the lower classes, often used in transactions between the people and government—a sure sign that the distinctions of Norman origin were nearly absorbed among the people at large.

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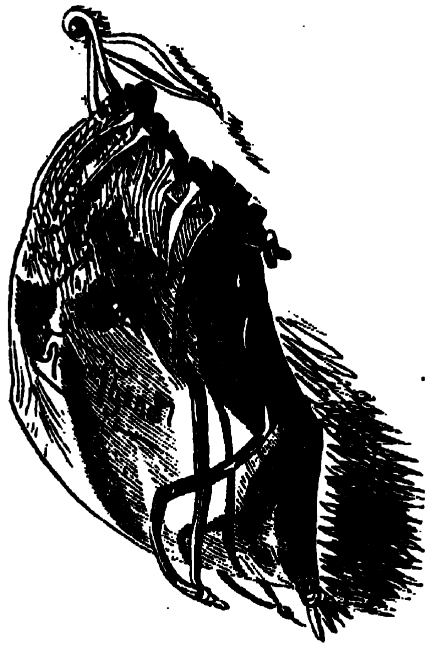
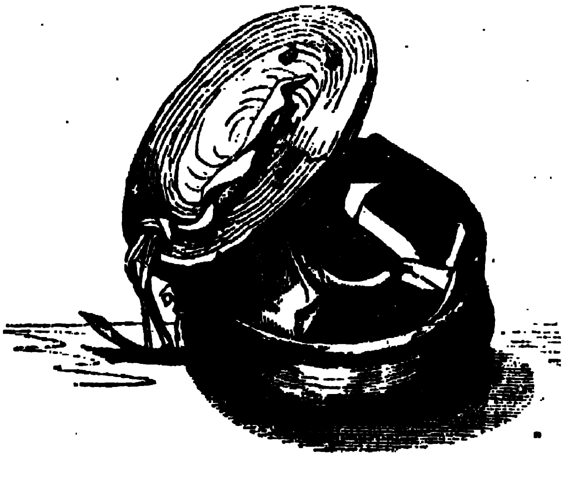
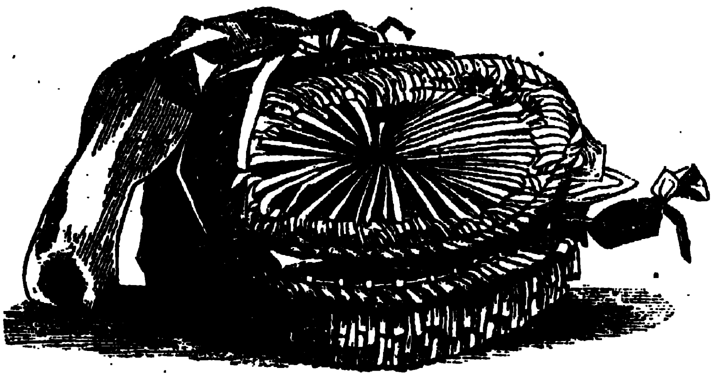
* The rolls of the Great Wardrobe exceed eighteen inches in width.

Sir Francis Palgrave's edition of the 'Calendars and Inventories of the Treasury of the Exchequer,' some of which were compiled as early as the fourteenth century, are extremely interesting in exhibiting the antient modes in which records were preserved. Whilst reading them we may imagine ourselves groping in the dark and damp vaults of the 'treasury' of the Exchequer, among the coffers, chests, boxes, and hampers filled with records, and the walls around us covered with small bags and pouches. No uniform system of arrangement seems to have been employed, but a different expedient was used for the preservation of nearly every separate document. Great numbers, judging from the quantity found in arranging the miscellaneous records of the king's remembrancer of the Exchequer, were kept in pouches or bags of leather, canvas, cordovan, and buckram, a mode which is still used in this department of the Exchequer. These pouches, which fasten like modern reticules, are described by Agarde, who was keeper of the treasury of the Exchequer, 'as hanging against the walls.' The following drawing represents a leathern pouch containing the tallies and the account of the bailiff of the manor of Gravesend in the 37 and 38 of Edward III.



When they have escaped damp, they have preserved their parchment contents for centuries in all their pristine freshness and cleanliness. Chests, coffers, coffins, and 'forcers' bound with iron and painted of different colours, cases or skippets,' or small turned boxes, and hanapers, or 'hampers of twyggys,' were also used.





These two last illustrations are about one-third of the size of the originals, which remain in the 'treasury' of the Exchequer.

Inscriptions on labels, letters, and 'signs' furnished the means of reference. We owe the following specimens of these 'signs' to the kindness of Sir Francis Palgrave, who has obliged us with the loan* of the blocks, cut for his calendars of the Exchequer before mentioned. These signs in most cases bear some analogy to the subject of the documents which they are intended to mark.

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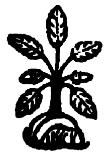

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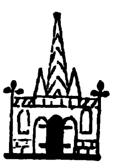

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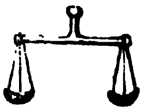

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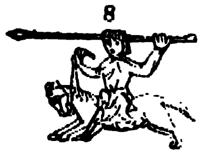

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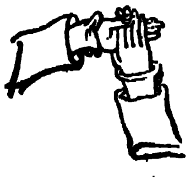

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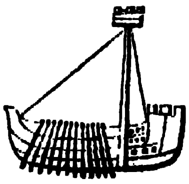

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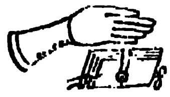

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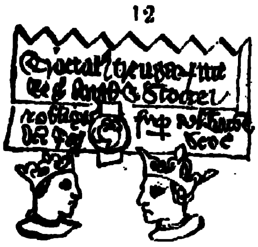

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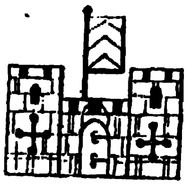

The rolls of the justices of the forest were marked by the sapling oak (No. 1). Papal bulls, by the triple crown. Four canvas pouches holding rolls and tallies of certain payments made for the church of Westminster were marked by the church (3). The head in a cowl (4) marked an indenture respecting the jewels found in the house of the Fratres Minores in Salop. The scales (5), the assay of the mint in Dublin. The Briton having one foot shod and the other bare, with the lance and sword (6), marked the wooden 'coffin' holding the acquittance of receipts from Llewellin, Prince of Wales. Three herrings (7), the 'forcer' of leather bound with iron, containing documents relating to Yarmouth, &c. The lancer (8), documents relating to Aragon. The united hands (9), the marriage between Henry, Prince of Wales, and Philippa, daughter of Henry IV. The galley

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* The Romans kept their records in 'Scrinia,' respectively distinguished as 'Scrinia Viatoria; Scrinia Stataria; Scrinia Palatii; Scrinia Sacra; Scrinia Augusta.'

(10), the recognizance of merchants of the three galleys of Venice. The hand and book (11), fealty to kings John and Henry. The charter or cyrograph (12), treaties and truces between England and Scotland. The hooded monk (13), advowsons of Irish churches. And the castle with a banner of the Clare arms (14), records relating to the possessions of the earl of Gloucester in Wales.

Our ancestors before the Norman conquest pursued no system of public registration, though there are numerous charters of the Anglo-Saxon kings and deeds between private individuals still existing, and historical events are found chronicled in monastic chartularies.

The Anglo-Saxons, whose judicial proceedings were conducted orally, had no records except the 'land-bocs' or charters. The transactions of the folk-moots were not registered or *recorded*, and in the administration of justice no reference was made to written precedents. In such a state of society, though the actual possession of land constituted one of the best titles to real property, still the 'land-boc' furnished evidence of it also. And so important were these 'land-bocs' considered, that when the monks of Ely purchased seven hydes and a half of land, they gave three hydes besides thirty 'aurei' to recover the charter or 'cyrograph' of the title. Duplicates and triplicates of these 'land-bocs' were made, and one 'part' was delivered into the custody of the Burthegn, or chamberlain, to be preserved in the 'horde,' or royal treasury.

When a written account is made of any act, it is clear that it is made not for the exclusive benefit of one party only. In the Doomsday-book of the Norman conqueror, we see evidence that his power was far from absolute. The financial registrations (Rotuli Pipæ) of Henry I., in whose reign the earliest example is found—the records of the judicial proceedings of the 'Curia Regis,' which begin with Richard I.—and the special acts of the monarch himself enrolled on the 'close,' 'patent,' and 'charter' rolls commencing in the reign of John—are all so many irresistible proofs how gradually larger interests were trenching on the will of the king, who formally recognised no other power than his own in the government of the kingdom. The judicial records of the King's Bench and Common Pleas, and the parliamentary records beginning with Edward I., are further evidence of the increasing influence of the nobles and commonalty of the realm.

The king was legally considered as possessing the sovereign power. His peace was broken when the subject fell by the hand of the murderer; his parliament was to be summoned; his honour to be vindicated; and his army to be levied. It was the king's exchequer, the king's wardrobe, the king's court, and essentially the king's chancery; for the chancellor's functions were originally those of a private secretary, combining duties both spiritual and temporal. Holding the keepership of the king's conscience, the chancellor was necessarily of the clerical body, and the chief of the king's chapel. The great seal was in his custody, and the scope of his secretarial duties embraced all those of modern times performed by our secretaries of state for the home and foreign departments; and of all the business transacted a systematic and orderly registration was preserved in the several inrolments called 'patent,' 'close,' 'charter,' &c. All records of these several departments formed part of the king's treasure; and, like the practice of the antient Persians five hundred years before the Christian æra, when Darius caused a search for the decree of Cyrus to be 'made in the house of the rolls, where the treasures were laid up in Babylon' (*Ezra*, 6, i.), were deposited in the king's 'treasuries.'[*] The mutual interest of all parties naturally made the preservation of the records an object of general solicitude; to the king, as they furnished indisputable precedents for his calls of military service and taxation; to the nobles in protecting them in their feudal rights and various privileges; and to the commons most of all, in limiting the powers both of king and nobles, sheltering them from capricious extortion, and securing to them a certain amount of consistency in the administration of justice.

The chamberlain of the exchequer was called 'une grand office, car il gardera le treasour del roy, s. les recordes.' In Henry III.'s reign there were treasuries in the Tower of London and the New Temple. From the latter place, in the 20th of Edward I., out of a chest secured by nine keys, certain records of the Chancery were taken by the king's orders. (*Rot. Claus.*, 20 Edward I., m 13 d.) The Tower had certainly become a permanent treasury for records in the 33rd of Edward I., when a transfer to it was directed to be made of all the papal privileges touching the crown or kingdom, from the treasury of the exchequer at Westminster. (*Rot. Claus.*, 33 Edward I., m. 3.) Another 'treasury' is described by certain 'memoranda,' made 19 Edward III., as within the cloister of Westminster Abbey, near the Chapter-House (thesauraria Regis infra Claustrum Abbatiæ Westmonasterii juxta Capitulum). This 'treasury' still remains. A single pillar supports the vaulted chamber, which is yet to be seen, with its double oak doors grated and barred with iron and locked with three keys, and its drawers and 'tills' labelled by Arthur Agarde, who was custos of the records it contained. In his 'Compendium of the Records in the Treasury,' compiled 1610, he says that 'the recordes of the kinge's majesties threasury at Westminster, under the custodie of the lord-threasurer and the two chamberlaines, were lay'd up for their better preservacion in fower severall threasauries under three severall kayes, kept by three sondry officers, distinct the one kay from another, and uppon each dore three lockes. The first in the Court of Receipt; the seacond in the Newe Pallace at Westminster, over the Little Gatehouse there; the third in the late dissolved abbey of Westminster, in the Old Chapter-House; the fourth in the cloister of the sayd abbey.'

The contents of several 'treasuries' at various periods seem to have been consolidated in the Chapter House of Westminster Abbey, which was fitted up in its present state for the reception of records by Sir Christopher Wren. The only existing depositories of records besides the Chapter-House which preserve the appellation of 'treasury,' are the rooms in the Rolls-House, being the 'treasury' of the King's Bench Records, and a portion of the Carlton Riding-House as the 'treasury' of the Common Pleas Records.

The demolition of the old 'treasuries' adjoining Westminster Hall scattered their contents in all quarters of the metropolis. Thus the records of the king's remembrancer, of the Exchequer, and the Common Pleas, migrated from Westminster Hall to the late Mews at Charing Cross; and thence, to make room for the National Gallery, to Carlton Riding-School. The records of the late lord-treasurer's remembrancer and Pipe-Office are entombed two stories deep in the vaults of Somerset House. Those of the King's Bench for a time rested opposite St. Margaret's Church, but were shifted to the Rolls-House in Chancery Lane to make room for the present Rolls Court at Westminster.

Thus from time to time have repositories, as well undignified with the antient title of 'king's treasury' as deficient in that careful superintendence which originally accompanied the title, arisen in all parts of London; and in 1837 a committee of the House of Commons reported that it had seen the Public Records, the most precious part of the king's 'treasure,' deposited at the Tower over a gunpowder-magazine, and contiguous to a steam-engine in daily operation; at the Rolls, in a chapel where divine service is performed; in vaults two stories underground at Somerset House; in dark and humid cellars at Westminster Hall; in the stables of the late Carlton Ride; in the Chapter-House of Westminster Abbey; in offices surrounded by and subject to all the accidents of private dwellings, as the Augmentation Office and First Fruits.' At the present time, besides the offices for modern records attached to each court, we may enumerate the following repositories, with their different localities, as containing the public records:—

The Tower, in Thames Street.
Chapter-House, Westminster Abbey.
Rolls Chapel, Chancery Lane.
Rolls House, Chancery Lane.
Duchy of Lancaster, Lancaster Place, Strand.
Duchy of Cornwall, Somerset House.
Common Pleas, Carlton Ride and Whitehall Yard.
Queen's Remembrancer's Records, in Carlton Ride and tower of Westminster Hall.
Augmentation-Office, Palace Yard, Westminster.
Pipe-Office, Somerset House.
Lord-Treasurer's Remembrancer, Somerset House.
Land Revenue, Carlton Ride.
Pell-Office, 1, Whitehall Yard.

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[*] Certain records of the Chancery followed the king in his migrations over the kingdom as late as Richard II. Religious houses were called upon to provide horses for the conveyance of them. Edward I., by writ, tested the 4th July, in the twenty-eighth year of his reign, commanded the abbot of Furness to provide a strong horse to carry the Chancery Rolls to York.

Exchequer of Pleas, 3, Whitehall Yard.
First-Fruits Office, Temple.

It would seem that as early as the commencement of the fourteenth century the officers charged with the custody of the records were found to be either insufficient or neglectful of the performance of their duties. Since the time of Edward II. scarcely a reign has passed without a special temporary agency being appointed to restore the public records to good order. The necessity probably arose from the functions of the officer charged with the care of the records being altogether changed, as in the instance of the master of the Rolls, who was the *bonâ fide* 'gardein des roules' in early times.

In the 14th Ed. II., the barons of the Exchequer were directed to employ competent clerks to methodise the records, which were 'not then so properly arranged for the king's and the public weal as they ought to be.' Again in the 19th year of Ed. II., certain commissioners were appointed for a similar purpose. In Edward III.'s reign, at least three like commissions were issued (*Rot. Claus.*; Annis 34 and 36; and *Rot. Parl.*, Anno 46). Statutes for the protection of records from falsification, erasure, and embezzlement were passed 8 Rich. II., c. 4, and 11 Hen. IV., c. 3. Other measures were taken by Hen. VI., Hen. VII., and Hen. VIII. Inquiries into the state of the Parliamentary, the Chancery, and Exchequer Records were prosecuted in Queen Elizabeth's reign. James I. proposed 'an office of general Remembrance for all matters of record,' and a State Paper Office, which Charles II. established. Nor were the reigns of Anne and the two first Georges wanting in investigations into the subject. Committees of both Houses of Parliament from time to time visited the several repositories, and the fire of the Cottonian Library in 1731 produced a report which describes the condition of most of the public repositories at that period. But the fullest examination into the state of the public records which has been made in recent times was effected by a Committee of the House of Commons, in 1800, conducted by lord Colchester, then Mr. Abbot, and the report of that Committee presents by far the most perfect and comprehensive account which has yet appeared of our public records, to which a period of forty years has added very little. This Report originated a commission for carrying on the work which its authors had begun. The Record Commission was renewed six several times between the years 1800 and 1831, and altogether suspended at the accession of the present queen. All the several record commissions during thirty years recited, one after another, that 'the public records of the kingdom were in many offices unarranged, undescribed, and unascertained;' that they were exposed 'to erasure, alteration, and embezzlement,' and 'were lodged in buildings incommodious and insecure.' The commissioners were directed to cause the records to be 'methodized, regulated, and digested,' bound and secured; to cause 'calendars and indexes to be made and 'original papers' to be printed. The present state of the Record Offices affords abundant evidence, that the record commissioners interpreted their directions in an inverse order; expending the funds entrusted to them rather in printing records than in arranging or calendaring them. And it is an undoubted fact that notwithstanding these commissions, records were 'embezzled'—and are still lodged in most 'insecure' buildings. A very full investigation into the proceedings of the record commission was made by a Committee of the House of Commons in 1835, and the reader who is curious to know more than our space allows us to state, may consult its Report. Certainly during the last half-century there has been no niggard expenditure in one shape or another in respect of the public records. It is not very easy to ascertain its total amount or the precise appropriation of it; but the following may be received as an approximation to correctness:—

Parliamentary Papers show that grants were made on behalf of the Record Commission between 1800 and 1831, to the amount of	£362,400
Between 1831 and 1839 inclusive . . .	125,700
Salaries, &c. for the custody of Records .	120,000
Fees, estimated on an average of the years 1829, 1830, and 1831, at least . . .	120,000
Removals of Records, estimated at . .	30,000
	758,100
Irish Record Commission, estimated at .	120,000
	£878,100

Of the grants made to the record commission, by far the greater part was spent in printing and the expenses connected therewith. At the conclusion of this paper we have given a list of the works that they published, many of which are undoubtedly of great utility.

A very important step has recently been taken by the legislature to provide for the better custody and preservation and more convenient use of the public records. An act was passed (1 and 2 Vic., c. 49) calculated to remedy effectually what preceding efforts had in vain attempted, by constituting a special agency for the custody of the records; to the want of which and a sufficient responsibility, all the defects of the old system are attributable. By this act the Master of the Rolls is made the guardian of the public records, having powers to appoint a deputy, and, in conjunction with the treasury, to do all that may be necessary in the execution of this service. The act contemplates the consolidation of all the records, from their several unfit repositories, into one appropriate receptacle; their proper arrangement and repair; the preparation of calendars and indexes, which are more or less wanting to every class of records; and giving to the public more easy access to them. Lord Langdale, the present master of the rolls, to whose influence the change of system is greatly due, has already brought the above act into as full operation as circumstances have allowed. The old custodyship of most of the offices has been superseded, and the offices are constituted branches of one central depository, the Public Record Office, which, until a proper building is ready, is at the Rolls House in Chancery Lane. The Victoria Tower of the new Houses of Parliament has been named as a likely repository for the public records. The arrangement and repair as well as the making of inventories of records have been generally begun in most of the offices.

Preparations are also making for a uniform system of calendaring, a gigantic work which a century will hardly see completed. To select what is useful from the judgments of a single court, the Common Pleas for instance, at least 1200 miles of parchment nine inches wide must be patiently read through; and yet, without the performance of this labour, these records can scarcely be consulted.

The principal changes which have been made for the better accommodation and access of the public may be seen in the following table:—

System before July, 1840.					*Present System.*
		Charges for			
Office.	Hours of Attendance.	Search.	Inspection of Record.	Copy of Record.	
Tower . . .	10 till 3	10s.	6s. 8d.	1s. per folio	Attendance 10 till 4. Search in all Indexes, Calendars, &c. 1s. Inspection of a Record 1s. Copies 6d. per folio. The public may make extracts or copies in pencil, hitherto forbidden or allowed as a favor.
Rolls Chapel .	10 till 3	1s. a year ea. name	2s. 6d. ea. Roll	5s. 6d. a sheet	
Chapter House	10 till 1	8s. 4d.		1s. per folio	
Carlton Ride (Common Pleas)	10 till 4 In term-time only	3d a term 2s. 6d. in Index		6d. per folio	
3, Whitehall Yard					
Common Pleas	No attendance				
Exch. of Pleas	No attendance	3d. a term		6d. per folio	
King's Bench (Rolls House)	No attendance	2s. 6d. in Index			

We can only find space to glance at the particular classes of the public records, noticing in the fewest words the more antient and valuable. No enumeration we could give would enable the reader to dispense with reference to the inventories, repositories, calendars, catalogues, and indexes which are printed, or those existing in manuscript in the various Record Offices. The best work of general reference is the 'Report of the Select Committee in 1800,' from which we have taken a brief analytical list of the subjects to which the public records relate. Though this list is not altogether what is to be desired, it is the best within moderate limits that we know of, and is sufficient to prove that there is perhaps no branch of the public administration of our country which is destitute of its authentic memorials. The subjoined list consists merely of the headings of a much fuller analysis of the public records, which shows also their age and place of deposit. It was compiled by Mr. Luders, and is printed in the above Report.

ENGLAND.

I. *The King, Royal Family, and Household.*

1. The King. 2. The Queen. 3. The Prince of Wales. Household Privy Seals and Correspondence. Principality of Wales. Duchy of Cornwall. 4. Custos Regni, Lieutenant, Protector, Regent, Lord Justices. 5. Household. 6. The King's Chamber.

II. *The Royal Councils.*

1. Parliament. The House of Lords. The House of Commons. 2. Privy Council.

III. *The Royal Prerogative.*

1. In Ecclesiastical Affairs. Before and after the Reformation. Proceedings of the Commonwealth. 2. In Civil Affairs. General Administration of the Realm. Honours and Offices. Trade and Coin. 3. In Military and Naval Affairs. 4. In Foreign Affairs.

IV. *The Royal Revenues.*

1. Ordinary. Land Revenues. Casual Revenues. 2. Extraordinary.

V. *Courts of Justice.*

1. Of Abolished or Obsolete Jurisdiction. Curia Regis. Placita de Assisis. Placita Itineraria. Placita Forestæ. Placita Coronæ. Placita Aulæ. Placita de Quo Warranto. Star Chamber Proceedings.. Court of Requests. Court of Wards and Liveries. Court of Augmentations. Surveyor-General's Court. Court of Chivalry: viz. Constable and Marshal. 2. Of Occasional Jurisdiction. Special Commissions. Court of Judicature for determining Differences after the Fire of London. High Court of Justice. 3. Of Established Jurisdiction. Chancery. Its Ordinary and Extraordinary Jurisdiction. King's Bench. Pleas of the Crown and in Civil Suits. Common Pleas. Exchequer of Account—The Queen's Remembrancer's Office, The Lord Treasurer's Remembrancer's Office. Exchequer of Receipt—Tellers, Tally Court, Auditor or Tally Writer, Pell Office, Auditors of Imprest, Commissioners for auditing the Public Accounts. Exchequer of Pleas and of Error. Marshalsea and Palace Courts. Session of Oyer and Terminer and Gaol Delivery for London, and Gaol Delivery for Middlesex. Great Sessions of Wales. Duchy of Lancaster. Counties of Palatine. Stannary Courts. Cinque Ports. Commissioners of Sewers. Quarter-Sessions and Clerks of the Peace. Maritime Courts—Admiralty Instance Court, Admiralty Prize Court, Court of Appeal in Prize Causes. Ecclesiastical Jurisdiction—Episcopal, Archiepiscopal, Appellate Jurisdiction, Deans and Chapters. Courts for offences in India.

VI. *Universities and Colleges, Schools, &c.*

1. Universities and Colleges. 2. Royal Schools, Chauntries, Hospitals, Colleges, Free Chapels, Fraternities, and Guilds.

VII. *Alienation of Private Property.*

SCOTLAND.

1. *The King.*

Title, Great Seal, Privy Seal, Signet, Chancery, Revenues, and Expenses. Acts of Civil Government. Ecclesiastical Government. 2. Parliament. 3. Privy Council. 4. General Registers. 5. Courts of Justice. Court of Session. Justiciary Court. Court of Exchequer. Admiralty Court. Commissary Courts. Court of Teind. Sheriff Court. 6. Universities.

IRELAND.

The principal Record Repositories in Dublin are the *Bermingham Tower*, which contains Plea Rolls, Pipe Rolls, Summonisters' Rolls, Sheriffs' Tot Rolls, &c.; the *Parliamentary Record Office;* the *Rolls Office;* the Statute Rolls from Hen. V. to the Union; Patent and Close Rolls from 31 Ed. I. to the present time; Inquisitions post Mortem; Fiants from 21 Hen. VIII. to the present time; Decree Rolls; Recognizance Rolls from 21 Hen. VIII; the *Chief Remembrancer's Office,* Memoranda Rolls from 6 Ed. I. to the present time; the *Auditor-General's Office,* Rolls of Public Accounts from Hen. VIII.; the Receiver-General, Vice-Treasurer's, Pell's, and Chamberlain's Books, the Debenture Exchequer Bills, and other Loan Books, the Vouchers of Public Accounts, the Collector's Accounts from every district in Ireland; the Quit-Rent Receipt Books, the Sheriffs' Accounts, with some Ancient Accounts of the Hanaper, First Fruits, Farmers of Revenue, Subsidies, Poll Tax, &c. The *Prerogative Office;* the *First-Fruits Office; Surveyor-General's Office.* (*Reports of the Commissioners on the Public Records of Ireland.*)

The most important Public Records may be enumerated as follows:—

Great Roll of the Exchequer, from Hen. II., 1154, to Geo. III., 1760.
Comptroller's or Chancellor's Roll, 11 Hen. II.—Geo. III., 1760 (now deposited in the British Museum).
Rotuli Curiæ Regis, Ric. I., 1194—Hen. III., 1216.
Fines, Concords, Writs of Covenant, Feet of Fines, &c., 25 Hen. II., 1179—Wm. IV., 1833.
Charter Rolls, John, 1199—Hen. VIII., 1509.
Norman Rolls, John, 1200—Hen. V., 1412.
Patent Rolls, John, 1201—present time.
Close Rolls, John, 1204—Geo. II., 1727.
Liberate Rolls, John, 1200—Edw. IV., 1460-1.
Fine Rolls, John, 1204—Chas. I., 1625.
French Rolls, Hen. III., 1232—Edw. IV., 1460-1.
Gascon Rolls, Hen. III., 1242—Hen. VI., 1422.
Scotch Rolls, Edw. I., 1291—Edw. IV., 1460-1.
Roman Rolls, Edw. I., 1305—Edw. IV., 1460-1.
Statute Rolls, (afterward the Parliament Roll,) Edw. I., 1277—Edw. IV., 1460-1.
Rolls of Parliament, Edw. I, 1272—Ric. III., 1483; Statutes, Hen. VII., 1485—Geo. II., 1727.
Petitions in Parliament, Edw. I., 1272—Edw. IV., 1460.
Journals of the House of Lords, Hen. VIII., 1509—to present time.
Journals of the House of Commons, Hen. VIII., 1509.
Summons and Returns to Parliament, Edw. I., 1288—Hen. VI., 1422; 33 Hen. VIII.—present time.
Original Acts of Parliament, 12 Hen. VII.—Wm. IV., 1830.
Inquisitiones post Mortem, or Escheats, Hen. III., 1216—Chas. I., 1625.
Inquisitiones ad quod damnum, Edw. II., 1307—Hen. VI., 1422.
Coronation Rolls, Edw. II., 1307—(series imperfect)—Geo. II., 1727.
Treaty Rolls (irregular series), Edw. V., 1483—James II., 1684-5.
Confirmation Rolls, Ric. III., 1483—Commonwealth, 1649.
Dispensation Rolls, 37 Eliz.—Geo. II., 1727.
Rolls of Pardons, Ric. III., 1483—Eliz. 1558.
Judgment or Decree Rolls of Chancery, 25 Hen. VIII.—Geo. II., 1727.
Surrender and Specification Rolls, Chas. II., 1648-9—present time.
Privy Seals and Signet Bundles, Bills, and Writs, Edw. I., 1272—present time.
Signed Bill Bundles, Hen. VII., 1485—present time.
King's Bench Judgments, &c. inrolled, Edw. I., 1272—present time.
Common Pleas Judgments inrolled, Edw. I., 1272—present time.
Placita Terræ of the Common Pleas, Eliz., 1558—present time.
Pleas of the Forest, Hen. III., 1216—James II., 1684-5.
Memoranda Rolls of King's Remembrancer, Hen. III., 1216—present time.
Originalia, Hen. III., 1216—Geo. III., 1760.
Miscellaneous Records of the King's Remembrancer, Ric. I., 1189—Geo. III., 1760.
Court of Augmentations, Ministers' Accounts, Hen. VIII., 1509—Chas. II., 1648.
Inrolments of Judgments, &c. in the Exchequer of Pleas, Hen. III., 1216—present time.
Placita de Assisis, 6 Ric. I.—Edw. V., 1483.

The preceding list exhibits generally, with a few exceptions hereafter noticed, the commencement of the chief and most valuable of our national records, and the periods over which they extend, from the time of Richard I., the boundary of 'legal memory.'

In the above list we have not included Domesday Book, the choicest of all our record treasures, and the cornerstone of our topographical history. The record itself has been most faithfully printed, and copiously described by Sir Henry Ellis. [DOMESDAY BOOK.] There are two abridgements of Domesday Book among the exchequer records, made probably about the time of Henry III. Subsequent territorial surveys, the Hundred Rolls, Extenta Manerii, Testa de Nevill, and Pope Nicholas' Taxation temp Ed. I., the Domesday of Wales, and Nonæ Rolls temp. Ed. III., King Henry VIII.'s Surveys, and Parliamentary Surveys of the Commonwealth, are excluded, because they form no consecutive series like the above.

The Great Roll of the Exchequer, or Pipe Rolls, or Rotuli Annales, being yearly accounts of the king's revenue, are conjectured to have begun with the Conqueror. Some evidence exists to establish that they probably extended over the whole reign of Henry I., though we know at present but of a single roll, the thirty-first year of that reign, which the Record Commission published under the editorship of Mr. Hunter. Excepting the rolls for the 1st of Henry III. and 7 Henry IV., the series from the 2nd of Henry II. is complete. Madox speaks of them as 'Recorda omnium quæ in Archivis Regis usquam me memini, splendidissima, post Rotulum censualem quem Librum Domesday vocant; quin ei æquiparanda.'

The series of Fines, being records of the transfer of lands, &c., extends unbroken, and almost unchanged in form, from the 25 Henry II. to the end of the year 1833, when this species of conveyance was abolished. [FINES.] Since the 16 Edward I. they have been delivered from time to time into the 'treasury' of the exchequer. Those in the Chapter-house and those lately kept by the Custos Brevium of the Common Pleas will shortly be united, and will present a series of records, like the Pipe Rolls and Rolls of the Curiæ Regis, unrivalled in all Europe. The Cartæ Antiquæ in the Tower are transcripts of charters descending from the Saxon times to Henry III. They are hardly to be considered as part of the splendid series of chancery rolls commencing in King John's reign. In noticing the chancery rolls it is quite superfluous to do more than refer the reader to the prefaces which Mr. Thomas Duffus Hardy has attached to his editions of the earliest close and patent rolls. If we were to continue to particularise documents of age and interest, such as the Norman pipe-roll of Henry I., the 'Rotulus de Dominabus, temp. Henry II.' (which was printed by Mr. Stacey Grimaldi, in 1830), the Red Book of the Exchequer, containing the laws of the Conqueror and those ascribed to Henry I. (which has been fully catalogued by Mr. Hunter, in the *General Report of Commissioners on Public Records*, 1837, p. 165), the Misæ and Præstita rolls of King John, or the Magnæ Chartæ of our kings, which were not inrolled in a systematic series until 1278, we should never conclude the subject. We therefore refrain from further specifications, and conclude this article with a list of the various publications of the Record Commissioners.

1. Domesday Book: seu Liber censualis Willielmi Primi, Regis Angliæ.

Domesday Book, 2 vols. folio, 1783.

Additamenta, consisting of the Exon Domesday, Inquisitio Eliensis, the Winton Domesday and the Boldon Book, and Indices, 2 vols. folio, 1816.

2. Statutes of the Realm, 9 vols. fol.; Alphabetical Index, 1 vol.; Chronological Index, 1 vol.: in all eleven volumes.

3. Fœdera, Conventiones, Litteræ, et cujuscunque generis Acta Publica, inter reges Angliæ, et alios quosvis Imperatores, Reges, Pontifices, Principes vel Communitates (being a new edition of Rymer's Fœdera).

4. Calendarium Rotulorum Patentium in Turri Londinensi (from John to Edward IV.), 1 vol. fol.

5. Calendarium Rotulorum Chartarum et Inquisitionum ad quod damnum (from John to Henry VI.), 1 vol. fol.

6. Calendarium Inquisitionum ad quod damnum (from 1 Edward II. to 38 Henry VI.).

7. Placitorum, in domo Capitulari Westmonasteriensi Asservatorum—abbreviatio, temporibus regum Richard I., Johannis, Henry III., Edward I. et Edward II., 1 vol. fol.

8. Testa de Nevill; sive liber Feodorum in Curia Scaccarii, temp. Henry III. et Edward I., 1 vol. fol.

9. Rotulorum Originalium in curia Scaccarii abbreviatio temporibus regum Henry III., Edward I., II., et III., 1 vol. fol.

10. The Parliamentary Writs, and Writs of Military Summons; together with the Records and Muniments relating to the suit and service due and performed to the King's High Court of Parliament and the Councils of the Realm, or affording evidence of attendance given at Parliaments and Councils, vol i.; vol. ii. divisions 1 and 2 and 3, fol.

11. Rotuli Hundredorum, temp. Henry III. et Edward I. in Turri Lond., et in Curia receptæ Scaccarii Westm. Asservati, 2 vols. fol., 1812.

12. Placita de Quo Warranto, temporibus Edward I. II., et III. in Curia Scaccarii Westm. Asservata, 1 vol. fol., 1818.

13. Calendarium Inquisitionum post Mortem, sive Escaetarum, 4 vols. fol. (from Henry III. to Edward IV.).

14. Nonarum Inquisitiones in Curia Scaccarii temp. Regis Edwardi III., 1 vol. fol., 1807.

15. Taxatio Ecclesiastica Angliæ et Walliæ, Auctoritate P. Nicholai IV., circa A.D. 1291, 1 vol. folio.

16. Valor Ecclesiasticus, temp. Henry VIII., Auctoritate Regia institutus, 6 vols., folio.

17. Calendars of the Proceedings in Chancery in the Reign of Queen Elizabeth; to which are prefixed Examples of earlier Proceedings in that Court, namely, from the Reign of Richard II. to that of Queen Elizabeth inclusive, from the originals in the Tower, 3 vols., folio.

18. Ducatus Lancastriæ Pars Prima:—Calendarium Inquisitionum post Mortem, &c., Temporibus Regum Edward I., Edward III., Richard II., Henry V., Henry V., Edward IV., Henry VII., Henry VIII., Edward IV., Regin. Mar., Phil. et Mar., Eliz., Jac. I., Car. I.

Pars Secunda:—A Calendar to the Pleadings, &c. in the reigns of Henry VII., Henry VIII., Edward VI., Queen Mary, Philip and Mary, and Elizabeth, 3 vols., fol.

19. A Catalogue of the Manuscripts in the Cottonian Library deposited in the British Museum, 1 vol., folio, 1802.

20. A Catalogue of the Harleian Manuscripts in the British Museum, 4 vols., fol., 1808-1812.

21. A Catalogue of the Lansdowne Manuscripts, 1 vol., fol.

22. The Acts of the Parliament of Scotland, vol. ii. to vol. xi.; from 1424 to 1707.

23. Registrum Magni Sigilli Regum Scotorum, in Archivis Publicis asservatum, A.D. 1306-1424, 1 vol. fol., 1814.

24. Rotuli Scotiæ in Turri Londinensi, et in Domo Capitulari Westmonasteriensi Asservati, 2 vols., fol.

25. Inquisitionum ad Capellam Domini Regis retornatarum quæ in Publicis Archivis Scotiæ adhuc servantur Abbreviatio, 3 vols, fol.

26. A General Introduction to Doomsday Book, 2 vols, 8vo.

27. Rotulus Litterarum Patentium 7 John: Transcripta Litt. Pat. Hiberniæ, temp. Henry V. and VI. Placita 52 Henry III., 8vo.

28. Rotuli Litterarum Clausarum ab anno 1204 ad annum 1224, 1 vol.

29. Rotuli Litterarum Patentium, A.D. 1201-1216, fol.

30. The Chancellor's Roll, or Antigraph of the Great Roll of the Pipe, 3 John, 8vo.

31. Rotulus Magnus Pipæ de anno 31 Henry I., commonly called the Roll of Stephen, 8vo.

32. Proceedings and Ordinances of the Privy Council in the reigns of Richard II., Henry IV., V., VI., 7 vols., 8vo.

33. Rotuli Normanniæ: John and Henry V., 8vo.

34. Excerpta e Rotulis Finium; Henry III., 2 vols., 8vo.

35. Rotuli de Oblatis et Finibus; John, 1 vol., 8vo.

36. Fines sive Pedes Finium, sive finales Concordiæ in Curiâ Domini Regis, A.D. 1195-1214, 8vo.

37. Rotuli Curiæ Regis Ric. I. et John, 2 vols., 8vo.

38. An Account of the most important Records of Great Britain, by C. P. Cooper, 2 vols., 8vo.

39. Selections from the Miscellaneous Records of the King's Remembrancer of the Exchequer, fol. (not yet issued).

40. Docquets of Commissions, Grants of Honors, Pardons, and other patents of Charles I. while at Oxford, 1642-46, 8vo. (not yet issued).

41. Antient Inventories and Calendars of the Treasury of the Exchequer, from Edward III. to Henry VIII., 3 vols., 8vo.

42. Documents elucidating the Ancient History of Scotland, Alexander III. to Robert I., 1 vol., 8vo.

43. The Charter Rolls of John, 1 vol., fol.

44. Antient Laws and Institutes of England, comprising laws enacted under the Anglo-Saxon kings from Æthelbert to Canute, with an English translation of the Saxon; the laws called Edward the Confessor's; the laws of William the Conqueror; and those ascribed to Henry I. Also Monumenta Ecclesiastica Anglicana, from the seventh to the eleventh century; and the antient Latin version of the Anglo-Saxon Laws, 1 vol., fol., 1840.

The printing of a considerable number of other works was in progress when the Record Commission dropped. What these were may be seen in the Commons' *Report on the Record Commission, App.*, p. 782.

RECOVERY, COMMON. A common recovery was a judgment in a fictitious suit, in which the tenant of the freehold was the defendant; and the judgment was given in consequence of default made by the person who was last vouched, that is, summoned to warranty in such suit. It was used for the purpose of barring estates tail and all remainders and reversions expectant thereon.

A common recovery was in the form of a judgment obtained in a real action, and accordingly the mode of proceeding was the same as in an action not fictitious. The plaintiff in the action, or demandant, who sought to recover the lands, sued out a writ or præcipe, at it was called, from the words of the writ (Praecipe A, the tenant, quod juste, &c. reddat B, the lands in question) against the person who had the freehold of the estate, and who was called the tenant to the præcipe. When the recovery was suffered by a tenant in tail in possession, he might himself be the tenant to the præcipe. The tenant of the freehold appeared to the writ by himself or by his attorney; but instead of defending his title, he vouched (vocavit) some other person who was supposed to be bound to warrant the tenant's title, and he prayed that the person so vouched (the vouchee) might defend the title so warranted, or that, if he could not, he might give the tenant lands of equal value with those which he might lose by failure of the warranty. The vouchee, having appeared, undertook the defence of the tenant's title, but he purposely failed to do so, and on his default the court gave judgment, which was that the demandant or recoveror should recover the lands against the tenant, and that the tenant should recover against the vouchee lands of equal value. Such lands were called the recompense or recovery in value. By the first judgment the demandant obtained the fee simple of the estate. The whole proceeding being a fiction, it was usual to make the common crier of the Court of Common Pleas the vouchee, who was hence called the common vouchee. This proceeding was called recovery with single voucher; but there might be recovery with double or treble voucher, in which case judgment was given against the several vouchees. In the case of double voucher, the tenant in tail conveyed an estate of freehold to some person, against whom the demandant brought the writ or præcipe. The tenant to the præcipe vouched the tenant in tail, who vouched over the common vouchee, who of course made default, and judgment was accordingly given for the demandant against the tenant to the præcipe, for the tenant to the præcipe against the tenant in tail, and for him against the common vouchee.

On judgment being given, a writ of habere facias seisinam was sued out, which was directed to the sheriff of the county, who was thereby ordered to put the demandant in possession of the lands in question. In practice the writ of seisin was not executed, but it was necessary that it should be returned, and when it was returned the recovery was complete.

The principal circumstances have been mentioned which were necessary to make a good recovery, and a defect in any one of them, or in any of the proceedings, might vitiate the recovery. One of these circumstances of the greatest practical importance was the making a good tenant to the præcipe; for unless the person against whom the writ was brought was actual tenant of the freehold, there could be no good recovery. It was however sufficient if he acquired the freehold at any time before judgment was given in the suit; and by 14 Geo. II., c. 20, § 6, it was sufficient if he acquired the freehold after judgment and the award of the writ of execution.

When the person who wished to suffer the recovery was tenant in tail in possession, the writ might be directed to him (as already observed), and he would be the tenant to the præcipe. But it was usual for the tenant in tail to be vouched, in which case some other person must be the tenant to the præcipe; and for the following reason:—The validity of the recovery was founded on the doctrine that the estate which the tenant in tail obtained by virtue of the warranty in lieu of that which he lost by the vouchee's default, would descend to the heirs in tail, just as the estate would have done which the tenant in tail had lost. It is true that the recompense could not extend to the person entitled to the reversion, nor to contingent interests; but this defect, which would have been fatal if the transaction had been real, was never considered to impair the efficacy of the fictitious proceeding. But it was a settled principle that the estate obtained by way of recompense would only follow the course of descent of that estate of which the tenant in tail was seised at the time of the recovery; and therefore if the tenant in tail at the time of the recovery was not seised of an estate tail according to the form of the original gift, the recompense in value would descend according to the estate which he had at the time of the recovery, and not according to the original gift; and consequently those who claimed under the original gift would not be barred because they obtained no recompense in value. It might happen in various ways that the estate which the tenant in tail had at the time of the recovery was not the estate tail according to the original gift. To prevent this inconvenience, the tenant in tail gave an estate of freehold to some person in order to make him a good tenant to the præcipe. This was done in various ways, but generally by bargain and sale enrolled, or by lease and release. The instrument which transferred the estate of freehold generally contained the declaration of the uses of the recovery, as hereinafter mentioned. The action being brought against the tenant to the præcipe, he vouched the tenant in tail, who vouched over the common vouchee. As the tenant in tail confessed the warranty, and undertook the defence of the action, he was considered to submit all his rights in the land to the effect of the recovery, which was called a recovery with double voucher. If the tenant in tail had only a vested estate in remainder, he could not make a tenant to the præcipe, and it was therefore necessary, in order to suffer a recovery, that the first person who had an estate of freehold in the lands should consent to make a tenant to the præcipe. But by 14 Geo. II., c. 20, it was not necessary for the tenant in tail to have the concurrence of the immediate freeholder, if he was merely a lessee for life subject to the payment of a rent; but if the estate tail was preceded by any estate or estates of freehold, besides that of the lessee for life, the concurrence of the holder of such estate, or of the first of such estates, was necessary. In many of the questions which have arisen on the validity of recoveries, the question has been whether there was a good tenant to the præcipe.

A common recovery was generally suffered in the Court of Common Pleas only; but common recoveries of lands in the counties palatine of Durham and Lancaster were suffered in the respective courts of those counties. A recovery of lands held in antient demesne was suffered in the courts of the manors of which such lands were held; and in many manors a recovery might be suffered in the customary courts of such manors of which the copyholds were parcel.

The writ of entry, as appears from its form, was not generally adapted to incorporeal hereditaments, yet such hereditaments were supposed to be included in it for the purpose of suffering a recovery. Though a rent charged on lands might be the subject of a recovery, a rent charged on personal estate could not. The interest, of which a recovery was suffered, might be an undivided share. As an equitable estate may be entailed, it was held that a common recovery suffered by a cestui que trust in tail in possession would bar such estate tail and all equitable remainders and reversions dependent upon it. In recoveries of this kind it was necessary that there should be an equitable tenant to the præcipe.

The effect of a common recovery differed in several respects from that of a fine. A fine was originally introduced as a mode of alienation by record, and its effect in barring entails was owing to the stats. 4 Hen. VII., c. 24, and 37 Hen. VIII., c. 19, which were not made till several centuries after the introduction of fines. A common recovery had no absolute effect after a fixed number of years, as a fine had; but inasmuch as the recoveror acquired an estate in fee simple, it had effects very different from those of a fine. A common recovery duly suffered defeated all the remainders and reversions expectant on the estate tail, and also all shifting uses and executory devises expectant upon it, provided the recovery was suffered before the contingency happened on which the executory devise was to take effect. A fine had the effect of destroying the estate tail by converting it into a determinable fee. Accordingly if the tenant in tail who had the immediate remainder or reversion in fee barred his estate tail by a fine, he acquired a base fee, which was merged in the remainder or reversion, which thus became an estate in possession, and subject to all the charges and estates made and created by the person from whom the tenant in tail derived his remainder or reversion. Besides this, it would be necessary for such person on any occasion of selling his land, to make out his title to the remainder or reversion. A common recovery operated by enlarging the estate tail into a fee, and thus absolutely destroying all remainders and reversions, but it confirmed all prior estates or charges made by the tenant in tail who suffered the recovery. Thus if a tenant in tail made a lease not permitted by the stat. 32 Henry VIII., or acknowledged a judgment, and then suffered a common recovery, this would be a confirmation of those charges, which, if there had been no recovery, would have had no effect against the issue in tail.

The origin of recoveries is referred to the decision in Taltarum's case, 12 Edw. IV., in which, though it was declared that the estate tail in question was not barred by the recovery suffered, the reason that was given for the decision admitted that it might have been barred by a recovery. In Taltarum's case, the tenant who suffered the recovery was not seised of the estate tail under which the issue in tail claimed, but he was seised of a different estate at the time of the recovery being suffered.

Those persons only were barred by a common recovery who were parties to it, and also the issue in tail, remaindermen, and reversioners, and all persons who claimed under any limitations expectant on or to take effect after the determination of the estate tail. But no estates or interests prior to the estate tail were affected by the recovery.

Recoveries were impeachable for various reasons, such as defect of jurisdiction in the court in which they were suffered, informality in the proceedings, and the want of a good tenant to the præcipe.

The immediate object of the recovery, as above observed, was to give an estate in fee simple to the recoveror; but the ultimate object was to commonly settle the estate to new uses, which were generally declared by the instrument which gave the estate of freehold to the tenant to the præcipe.

By 3 & 4 Will. IV., c. 74, fines and recoveries are abolished, formal defects in those already levied or suffered are cured, and more simple modes of assurance are substituted. The substitution provided by this Act for the barring of an estate tail and all estates and interests to take effect after the determination of or in defeasance of the estate tail, is an assurance by deed to be enrolled in the court of chancery within six calendar months after its execution.

RECRUITING is the act of raising men for the military or naval service, either to augment the numerical strength of an army or fleet by new levies, or to make good the complement of any regiment or ship. The term may be used when men are obtained in any of the ways which the customs of nations have sanctioned or the necessities of certain times may have required; but among military men it is employed when officers, especially appointed for the purpose, engage men by the offer of bounties to enter as private soldiers into particular regiments. The officers, commissioned and non-commissioned, while so employed, are said to be on the recruiting service; but the actual engaging of men as recruits is called enlistment; and the laws relating to this subject have been already noticed. [ENLISTMENT.]

Formerly private persons were allowed to enlist men for the army in any way that they might think best; but these having sometimes adopted, in order to procure recruits, violent and illegal means by which the public indignation was excited, the government in 1802 took the management of the recruiting department into its own hands; and now, by a clause in the Mutiny Act, any person advertising or opening an office for recruits without authority in writing from the adjutant-general or the directors of the East India Company is liable to the penalty of twenty pounds.

In order to produce uniformity in the system of recruiting, and to ensure the employment of legal means only in obtaining men, the supreme control of this branch of the military service was vested in the adjutant-general of the army, and both Great Britain and Ireland were divided into several recruiting districts. To each of these was appointed an inspecting field-officer; an adjutant, whose duty it is to ascertain, in respect of stature and bodily strength, the fitness of any recruit for the service; a paymaster, and a surgeon, the latter of whom is to report concerning the health of the recruit. Under the inspecting field-officer there are several regimental officers, who are stationed in the principal towns of the different districts in order to superintend the non-commissioned officers appointed to receive the applications of the persons who may be desirous of entering the service.

England and Wales together are, for the recruiting service, divided into five districts, of which the first comprehends all the counties lying north of the Humber; the head-quarters for this district are at Leeds, which is the station of the field-officer, and there are superintending officers in that town, and also at York and Bradford. The second district comprehends North Wales and the inland counties eastward as far as Derbyshire inclusive; the head-quarters are at Liverpool, and there are superintendents at that place, and also at Manchester and Sheffield. The third district comprehends South Wales and the inland counties eastward as far as Lincolnshire inclusive; the head-quarters are at Coventry, and there are superintendents at Leicester, Birmingham, Shrewsbury, Nottingham, Lincoln, and Stamford. The fourth district includes the south-western counties of England as far as Hampshire; its head-quarters are at Bristol, and there are superintendents at Gloucester, Salisbury, and Exeter. Lastly, the fifth district comprehends all the eastern counties south of Lincolnshire; the head-quarters are at Westminster, and there are superintendents in London, at Reading, Ipswich, and Norwich.

The head-quarters of the recruiting department in Scotland are at Glasgow, and there are superintending officers in that city, at Edinburgh, Perth, Aberdeen, and Inverness.

Ireland is divided into three recruiting districts. The head-quarters of the first or northern district are at Newry, and, besides the superintendent at that place, there are others at Enniskillen, Belfast, and Derry. The head-quarters of the central district are at Dublin, and there are superintendents also at Athlone and Cavan. Lastly, the head-quarters of the third or southern district are at Cork, and there are superintending officers at Limerick and Kilkenny.

The chief recruiting depôt for the East India Company's forces is at Chatham, and there are superintending officers in London, at Liverpool, Dublin, and Cork.

In order to procure recruits, a serjeant or other non-commissioned officer mixes, in country places, with the peasantry at their times of recreation; and, in towns, with artisans who happen to be unemployed, or who are dissatisfied with their condition; and, by address in representing whatever may seem agreeable in the life of a soldier, or by the allure of a bounty, occasionally induces such persons to enter the service.

The reports concerning the fitness of a recruit for military service are finally submitted for approval to the inspecting field-officer of the district, except when the distance of the head-quarters from the place where the recruit is enlisted is such that it would be more convenient to send the latter to the depôt of the regiment to which he is to belong: in that case the officer commanding at the depôt is especially authorised to sanction them.

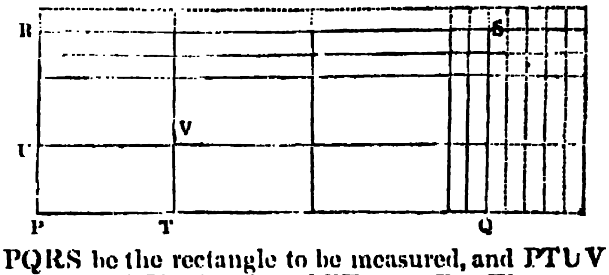
Officers employed on the recruiting service are not allowed to interfere with one another in the performance of their duties; particularly, no one is permitted to use any means in order to obtain for his own party a man who has already taken steps by which he may become engaged to another.

RECTANGLE (or right angled), the name given to any figure of which all the angles are right angles. Hence the figure, having as many right angles as sides in the sum of its angles, must be foursided; for none but a foursided figure has the sum of its angles equal to four right angles. It is unnecessary to give a diagram of the most common of all the forms of art; the page of this book may serve as an instance.

The properties of the rectangle, to which it owes its importance in a mathematical point of view, consist of one which it shares in common with all parallelograms, and one which marks it as the most simple of parallelograms. Every parallelogram, and the rectangle among the rest, may be divided in an infinite number of ways into parallelograms having the same angles as the original parallelogram; and if any parallelogram be divided into others by lines drawn parallel to one only of the sides, the smaller parallelograms bear to the whole the same proportion as their several bases bear to the whole base. Also, the area of a rectangle may be immediately deduced from nothing but the length of its two sides. If as a superficial unit we choose a rectangle having the sides A and B, it may immediately be told how many times and parts of times any other rectangle contains the unit. Measure one side, and see how many times it contains A (say 2⅔); measure the other side, and see how many times it contains B (say $3\frac{2}{7}$); then the product of $2\frac{2}{3}$ and $3\frac{2}{7}$, or

$$\frac{8}{3}\times\frac{23}{7}, \text{ or } \frac{184}{21}, \text{ or } 8\frac{16}{21},$$

is the number of times which the rectangle to be measured contains the unit rectangle. This may be shown as follows:—



Let PQRS be the rectangle to be measured, and PTUV the unit rectangle, PU being A, and PT being B. The rectangle RQ is so drawn that PR contains $2\frac{2}{3}$ of A, and PQ contains $3\frac{2}{7}$ of B. The whole rectangle is obviously divided into six rectangles of the size of PV: six at the top, each of which is one-third of PV; four on the right, each of which is one-seventh of PV; and four higher up on the right, each of which is the twenty-first part of PV. We have then, on the whole, PV repeated

$$6+\frac{6}{3}+\frac{4}{7}+\frac{4}{21}, \text{ or } \left(2+\frac{2}{3}\right)\left(3+\frac{2}{7}\right) \text{ times.}$$

In practice it is most convenient to make PT and PU equal to one another, and equal to the unit used in measuring lengths. Hence the rule for finding the area of a rectangle is: multiply together the number of linear units in the two sides, and the result is the number of square units (or squares on the linear unit) in the rectangle. This rule is abbreviated as follows: the product of the sides of a rectangle is the area; an abbreviation which often confuses the mind of a beginner, who imagines that two *lines* can be multiplied together [Multiplication], and that the rectangle, that is, the very shape of the rectangle, is the product; a mistake precisely that of a person who should imagine that the very silver of ten shillings could be multiplied by seven yards of stuff, and that the product could be seventy shillings. Now seven yards of stuff at ten shillings a yard certainly cost as many shillings as there are units in 7 × 10; and a rectangle whose sides are seven and ten feet certainly contains as many square feet as there are units in 7 × 10; but seven feet can no more be multiplied by ten feet than seven shillings by ten yards of silk.

When however given words imply a false proposition, there are two modes of proceeding, either to alter the words or to alter the meaning of the words. If a person should be so accustomed to talk of multiplying concrete quantities together that he cannot avoid it, he must learn to define multiplication as the finding of a fourth proportional to three concrete quantities, the first of which is a concrete unit. If this be the meaning of multiplication, then six yards and three yards can be multiplied together; for as one yard is to three yards so is six yards to eighteen yards, and eighteen yards is the product. But this product is a line, not an area.

The pertinacity with which some writers still persist in calling the product of two lines the area of a rectangle (not only as a practical rule of mensuration, in which it is a desirable mode of expression, but in matters of reasoning) is the result of a long-continued habit formed in the first instance by the study of the Greek writers. For though these do not confound the product with the area; yet, on account of the deficiencies of their algebraical system, they used the area instead of the product, and gave the names of spaces to the results of numbers. Thus the product of two numbers was called plane, that of three equal numbers solid, that of two equal numbers a square, that of three equal numbers a cube, and the difference of two square numbers a gnomon. To these we may add the titles of polygonal, pyramidal, &c. numbers [Numbers, Appellations of], and others which it is needless to mention. All arithmetical propositions were made to take the form of geometrical ones: thus to multiply two numbers was to form the rectangle of two given lines; to divide one number by another was, given the area of a rectangle and one of its sides, to find the other side. We have seen it stated that the word παραβολή (parabola) was sometimes used for quotient, and, it was said, in Diophantus. We cannot find it there, though it may be used by the scoliast, whom we have not examined. But most certainly the explanation of the meaning of parabola, as applied to the well-known curve, comes from some such signification. The term parabola means a thing laid near to or by the side of another; for comparison, for instance, as in the common word parable, or for any other purpose. Now in the conic section in question the square on the ordinate being converted into a rectangle one of whose sides is the abscissa, the remaining side (being that which must be laid by the first side before the figure can be drawn, or the παραβολη) is always of the same length. If modern writers had applied the term parabola to this remaining side, they would probably have called the curve an isoparabolic section; but the Greeks, who called the curve in which a certain defect is always in the same proportion to the whole by the simple name of defect (ellipse), and one having the same sort of excess by the simple name of excess (hyperbola), called the isoparabolic curve simply a parabola. Montucla supposes that as ellipse means defect, and hyperbola excess, parabola must mean equality; but even supposing that an etymological justification of this meaning could be made, that which is defect in the ellipse and excess in the hyperbola does not become equality in the parabola.

Of the geometrical system which pervaded the Greek arithmetic, we have permanently retained only the words square and cube; rectangle was frequently used for product, but is rarely at present. These words are the causes of much confusion to students who begin to apply arithmetic to geometry. Thus in algebra the square of a sum is equal to the sum of the squares of the two quantities, together with twice their product. In geometry the square of the sum of two lines is equal to the sum of the squares on the lines, together with twice their rectangle. Those who are not made to see clearly the distinction of these propositions confound them together. A sufficient distinction might be made by a little variation in phraseology: speak of the square *on* a line, and the square *of* a number. Thus 49 is the square of 7: erect two perpendiculars each equal to AB at the two extremities of AB, and joining their other extremities completes the square *on* AB. It is already customary to speak of the rectangle whose contiguous sides are AB and AC, as the rectangle *under* AB and AC.

The second book of Euclid is devoted to the properties of the rectangle, as they arise from subdivision into other rectangles. Some persons advocate what is called the arithmetical proof of these propositions, namely, the substitution of the analogous properties of numbers for those of rectangular spaces. This question must be settled in the same manner as that of Proportion, and the remarks in that article apply. If all pairs of lines were commensurable, no objection could be taken against the rigour of the substitution; but unless a theory of incommensurables, and a modification of the definition of multiplication to suit them, be formally introduced, the method of Euclid is sound, and the substitute for it unsound; though proper enough for the adoption of those who, as explained in the article cited, only wish to become mathematicians to a certain number of decimal places.

RECTIFICATION means the finding of a straight line equal in length to an arc of a curve [Arc], and is analogous to the term quadrature, as applied to finding its area; for in like manner as an area is considered to be known when a square equal to it is exhibited, so the length of an arc is known when a straight line equal to it is exhibited.

Of the celebrated problem of the rectification of the circle we have said enough under Quadrature of the Circle, in which article it appears that the rectification gives the quadrature; so that the latter problem was generally attempted through the former.

RECTOR, RECTORY. [Benefice.]

RECULVER. [Kent.]

RECURRING SERIES. By a recurring series is meant one of the form

$$a_0+a_1x+a_2x^2+a_3x^3+a_4x^4+\ldots.$$

ad infinitum, in which the coefficients a_0, a_1, &c. can each be expressed by means of certain preceding coefficients and constants in one uniform manner; and it is usual to consider only such series as will admit of a linear relation (or one in which only first powers of coefficients enter): thus the series

$$1+x+4x^2+13x^3+53x^4+172x^5+\ldots.$$

follows the linear law $a_n=3a_{n-1}+a_{n-2}$ (4 = 3.1+1, 13 =

3.4+1, 53=3.13+4, &c.), and is what is commonly called a recurring series, though the following—

$$1+x+2x^2+5x^3+29x^4+866x^5+ \text{\&c.},$$

in which $a_n=a_{n-1}^2+a_{n-2}^2$ is equally recurring, according to the definition. The recurrence alluded to is not that of terms, but of method of determining terms; and it would be desirable that the series which are usually called recurring should be *linearly* recurring series, while any in which there is really recurrence (of law) should be called recurring.

Every linearly recurring series is the development of an algebraic function with a rational and integral numerator and denominator, and every such function can be developed into a linearly recurring series. Thus, taking the first series mentioned, in which $a_n=3a_{n-1}+a_{n-2}$, we have

$$a_2 x^2=3a_1 x^2+a_0 x^2$$
$$a_3 x^3=3a_2 x^3+a_1 x^3$$
$$a_4 x^4=3a_3 x^4+a_2 x^4, \text{ \&c.}$$

Let S be the sum of $a_0+a_1 x+$, &c., ad infinitum. Then the preceding obviously gives

$$S-a_0-a_1 x=3x(S-a_0)+x^2 S;$$

$$\text{or, } S=\frac{a_0+(a_1-3a_0)x}{1-3x-x^2}$$

We have here the value of any series in which this law of recurrence prevails for all terms after the second; and it cannot prevail before, since two terms must exist before a third can be expressed. In the case we chose, $a_0=1$, $a_1=1$, whence the function of which the series was the development is $(1-2x)\div(1-3x+x^2)$.

Generally, a linear recurring series having the law of recurrence

$$a_n=p_1 a_{n-1}+p_2 a_{n-2}+\ldots\ldots+p_t a_{n-t}$$

is the development of the function

$$\frac{A_0+A_1 x+A_2 x^2+\ldots\ldots+A_{t-1}x^{t-1}}{1-p_1 x-p_2 x^2-\ldots\ldots-p_t x^t}$$

where $A_0=a_0$, $A_1=a_1-p_1 a_0$, $A_2=a_2-p_1 a_1-p_2 a_0$, ...

$$A_{t-1}=a_{t-1}-p_1 a_{t-2}-p_2 a_{t-3}-\ldots\ldots-p_{t-1}a_0,$$

from which the inverse theorem may easily be derived, namely, that

$$\frac{A_0+A_1 x+A_2 x^2+\ldots\ldots+A_{t-1}x^{t-1}}{B_0+B_1 x+B_2 x^2+\ldots\ldots+B_{t-1}x^{t-1}+B_t x^t}$$

can be developed into $a_0+a_1 x+a_2 x^2+$ &c., in which the law of recurrence (n not being $<t$) is as follows:—

$$B_0 a_n+B_1 a_{n-1}+B_2 a_{n-2}+\ldots\ldots+B_t a_{n-t}=0,$$

and the terms up to a_{t-1} are determined by

$$A_0=B_0 a_0,\ A_1=B_0 a_1+B_1 a_0,\ A_2=B_0 a_2+B_1 a_1+B_2 a_0$$
$$\ldots\ldots A_{t-1}=B_0 a_{t-1}+B_1 a_{t-2}+\ldots\ldots+B_{t-1}a_0.$$

Those who understand the theory of generating functions will see that the generating function can thus be found to the solution of any linear equation of differences. Some use may thus be made of recurring series in various questions of the theory of probabilities; but, generally speaking, this species of series is not of the most useful kind, connected as it is with the rational and integral function of algebra, which is of little application compared with the irrational and transcendental function. [SERIES.]

The most simple mode of finding the law of the terms of a recurring series is by the solution of the equation of differences, which expresses the relation of the coefficients. This may be verified by decomposing the function which is developed into the series into fractions with denominators of the first degree, according to the common method used in the integral calculus, and expanding each fraction separately.

RECURVIROSTRA. [AVOSET.]

RECUSANTS are persons who refuse or neglect to attend divine service on Sundays and holidays, according to the forms of the Established Church. Before the Reformation, ecclesiastical censures were directed at different times by provincial councils against those who absented themselves from the services of the church. But the noticing of recusancy in the temporal courts, and probably the use of the term itself, cannot be traced higher than the sixteenth century. By the 1 Eliz., c. 2, it is enacted 'that all persons shall diligently and faithfully, having no lawful or reasonable excuse to be absent, endeavour to resort to their parish church or chapel accustomed, or upon reasonable let (hindrance) thereof, to some usual place where common prayer, &c. shall be used, in time of such let, upon every Sunday and other days ordained and used to be kept as holy days, and then and there to abide orderly and soberly during the time of the common prayer, preaching, and other service of God there to be used and ministered, upon pain of punishment by the censures of the church, and also upon pain that every person so offending shall forfeit for every such offence twelve pence.' By 23 Eliz., c. 1, it is enacted, 'that every person above the age of sixteen years who shall not repair to some church, chapel, or usual place of common prayer, but forbear the same, contrary to the tenor of the statute of 1 Eliz., c. 2, and being thereof lawfully convicted, shall forfeit for every month which he or she shall so forbear, twenty pounds.' This statute has been held not to dispense with the forfeiture imposed by the former statute. By 35 Eliz., c. 1, it is enacted, that if recusants, within three months after conviction, refuse or neglect to submit, they may, upon the requisition of four justices of the peace, be compelled to abjure and renounce the realm; and if they do not depart, or if they return without licence from the crown, they are guilty of felony, and to suffer death as felons without benefit of clergy.

The law recognised four classes of offenders under the statutes against recusancy:—those who absented themselves from the public service of the church from indifference, irreligion, or dissent, were termed 'recusants' simply—after conviction they were styled 'recusants convict;' those absentees who professed the Roman Catholic religion were called 'Popish recusants;' and those who had been convicted in a court of law of being Popish recusants were called 'Popish recusants convict.'

The laws against Popish recusants convict were of a very severe character. Montesquieu characterises them as so rigorous, that though not professedly of the sanguinary kind, they did all the hurt which possibly could be done in cold blood. The answer of Blackstone to this charge is rather a strange one, namely, that these laws were seldom executed to their utmost rigour, or, in other words, that they were enacted principally in terrorem. The truth appears to be that the first penal statutes passed for the purpose of compelling the adherents of the old religion to adopt the new, provoked resistance on their part; and this resistance caused severer enactments, producing in their turn increased resistance, followed by the imposition of still more rigorous penalties.

Popish recusants, in addition to the general penalties enacted against recusants, were disabled from taking lands, either by descent or by purchase, after eighteen years of age, until they renounced their errors. They were bound at the age of twenty-one to register the estates which they had already acquired, and were bound also to register all future conveyances and wills relating to them. They were and are [QUARE IMPEDIT] incapable of presenting to any advowson, and of making a grant of the right of presenting at any avoidance of the benefice. They could not keep or teach any school, on pain of perpetual imprisonment. For the offence of saying mass, the Popish recusant forfeited 200 marks, or 133*l.* 6*s.* 8*d.* For the offence of wilfully hearing mass, he forfeited 100 marks (66*l.* 13*s.* 4*d.*), and was in each case subjected to a year's imprisonment.

Popish recusants convict incurred additional disabilities, penalties, and forfeitures. They were considered as persons excommunicated: they could not hold any public office or employment; they were not allowed to keep arms in their houses; they were prohibited from coming within ten miles of London, under the penalty of 100*l.*; they could bring no action at law or suit in equity; they were not permitted to come to court, under pain of 100*l.*, or to travel above five miles from home except by licence, upon pain of forfeiting all their goods. Severe penalties were imposed in respect of the marriage or burial of the Popish recusant convict, or the baptism of his child, if the ceremony were performed by any other than by a minister of the Church of England. Such a recusant, if a married woman, forfeited two-thirds of her dower or jointure, was disabled from being executrix or administratrix of her husband, and from having any part of his goods, and she might be kept in prison, unless her husband redeemed her at the rate of 10*l.* per month, or by the profits of the third part of all his lands.

Protestant dissenters were relieved from the penalties of recusancy at the Revolution, by the Toleration Act, 1 William & Mary, c. 18. This statute contained a proviso (s. 17) that nothing therein contained should extend to give any ease, benefit, or advantage to any Papist or Popish recusant, or to any person that should in his preaching or writing deny the doctrine of the Trinity. But in 1791, by 31 Geo. III., c. 32, Roman Catholics taking a certain oath therein presented (altered in 1829, by the Catholic Relief Act, 10 George IV., c. 7) were exempted from prosecution, for being Papists and for not resorting to church; and in 1813, by 53 George III., c. 160, the exemption in the Toleration Act, as to persons denying the doctrine of the Trinity, was repealed. The statutes against recusancy, though seldom enforced, are still subsisting with respect to persons who, not being Roman Catholics or Protestant dissenters, absent themselves from the service of the Established Church.

RED. [CALICO PRINTING; DYEING; ENAMEL; PAINTING, HOUSE.]

RED-BREAST. [SYLVIADÆ.]

RED DEER. [DEER, vol. viii., p. 358.]

RED LEAD. [LEAD, p. 370.]

RED MARL. An argillaceous red portion of the series of rocks between the coal and lias is thus termed in geology. Almost identical marls, similarly associated with red sandstones lie also in the upper part of the coal, and below the coal and mountain limestone. Nor would it be always easy to distinguish in specimens or even in sections on a large scale the upper red marls immediately below the lias of the Trent or the Avon from the red marls above the non-magnesian limestone of Knottingley, those above the magnesian limestone of Pontefract, those below the same limestone near Wetherby, those in the upper part of the coal formation of Manchester, or below the whole of the coal and mountain limestone in Monmouthshire. The phenomena attending the red colour in these deposits are entirely similar to those mentioned under RED SANDSTONE.

RED RIVER. [MISSISSIPPI, River.]

RED SANDSTONE. In geology this term is used in a variety of senses, partly with reference to the mere colour of certain rocks, and partly as expressing rocks of certain geological periods. Thus we have in the latter sense new red sandstone, lower red sandstone, and old red sandstone; and on the Continent, alter rother sandstein, neuer rother sandstein, le vieux gres rouge, le nouveau gres rouge, &c. The red sandstone also means, in some geological works, either the upper part or the whole system of the rocks, calcareous, argillaceous, and arenaceous, which occurs in the series of strata between the coal formation and the lias. If we regard the analogy of the geological nomenclature most generally used, this latter sense will appear too inconvenient to be adopted. as substitutes we have the Pœcilitic system, from the various colours of the component masses; and the Saliferous system, from its frequently containing salt. Under SALIFEROUS SYSTEM and in the article GEOLOGY will be found some general views. Our intention at present is to speak of red sandstones as mineral aggregates and as single terms which occur in several parts of the great series of stratified deposits.

Sandstones or gritstones, generally speaking, consist of abraded and worn pieces of quartz, felspar, mica, and other minerals, such as commonly occur in granite, gneiss, or mica schist, and other rocks associated with these. The size of these pieces is sometimes such as cause the mass to deserve the title of conglomerate (as part of the millstone-grit of Derbyshire), and sometimes the grains are so fine and confluent, that the mass is not unlike some sorts of quartz rock (as the ganister of the Yorkshire coal-field). In regard to induration, there is every degree from uncoherent sand, through friable and argillaceous sandstones, to compact grits and indurated quartzose rocks. In colours they admit of every shade from whiteness, through grey tints by carbonaceous admixture, through yellow and brown hues by admixture of carbonate and oxide of iron, and through reds, blues, and purples of different kinds by diffusion of oxides of iron, manganese, &c.

In this most complex series of detrital deposits, red sandstones present some remarkable characters when regarded as to the *nature* and *diffusion* of red colour, the *association* of this with other tints, the *relation* of their hues to organic life, and to other geological phenomena.

Red sandstones occur in the basin of the Allier in France, in tertiary strata; in the plastic clay group of the Isle of Wight; generally in the strata below the lias and above the coal; in the upper parts of the coal formation of Derbyshire and Lancashire; in the millstone-grit series of Lancashire; in the mountain limestone of the north of England; generally in the strata called old red sandstone, above the strata of the Silurian districts; in the midst of the green and purple slates of north and south Devon; in the midst of older rocks in the Lammermuir, Cavan, and Longmynd ridges; but the most perfect and abundant types are in those parts of the series which lie above and below the carboniferous rocks, and constitute the new and old red sandstone groups.

The essential peculiarity of these reddened rocks is apparently a general diffusion in their mass, and especially round their constituent grains of quartz, of red peroxide of iron (with also often some oxide of manganese?). If by means of muriatic acid the iron be removed from the red sandstone of Manchester, what remains is a mass of mostly white and even translucent quartz grains, which had been invested by the red oxide of iron. Singularly enough, amidst a great series of such red sandstones and red clays, nothing is more common and even characteristic than to find oval, round, or irregular patches of light green colours, apparently due to the protoxide of the same metal. Nor is it at all rare to find perfectly white bands alternating with red or green stripes; and this applies almost equally to the sandstones, clays, gypsum bands, and salt layers.

A very remarkable and general fact observed in studying these red rocks is the paucity of the remains of animals of every grade. The new and old red sandstones of England were once believed to contain no such remains; a mistake certainly, yet founded on an important truth, which is even illustrated by the exceptions. Perhaps a more striking proof of the reality of the inverse relation here indicated, is given in the fossiliferous districts of north and south Devon, where the slaty rocks often do contain, and in particular layers abundantly, remains of zoophyta, conchifera, crustacea; but the bands of red sandstones, hard or soft, massive or laminated, argillaceous or gritty, appear almost utterly devoid of these reliquiæ. Thus in North Devon we have the following series of phenomena in a descending order:--

Blue, green, &c. slates of Ilfracombe	Partially fossiliferous.
Red sandstones of Martinhoe . .	No fossils.
Green, grey, &c. slates of Linton	Very fossiliferous.

And in South Devon—

Blue and grey slates of Bovisand .	Fossiliferous.
Red sandstones of Staddon . .	No fossils.
Blue and grey slates and limestone of Plymouth	Fossiliferous.

(See De la Beche, *Report on Geology of Cornwall, Devon, and West Somerset.*)

The explanation which seems most probable is that water in which by any cause abundance of peroxide of iron has been diffused, is rendered thereby unsuitable for the due performance of the vital functions of aquatic creatures, especially such as take the water into their bodies for respiration, or are nourished by the flowing of currents to the mouth. We have been informed that experiments lately made by Mr. De la Beche, by putting red oxide of iron into water in which branchiferous mollusca were living, have justified the inference, and it seems desirable that such should be prosecuted and extended.

The last point on which it seems here necessary to remark is the frequent concurrence of red sandstones and clays, fibrous and lamellar gypsum, fibrous and lamellar rock salt. Most of the rock salt, of Europe at least, is associated with red earthy deposits; but there are great exceptions, as at Salzburg and Wieliczka. This frequent concurrence will be found of great importance in reasoning on the physical agencies whereby the peculiarities of red sandstones were occasioned.

As building materials, few of the red sandstones are to be recommended, and even the white layers which accompany them are seldom of much value. The cathedrals of Carlisle and Chester, and the noble old churches of Coventry, offer a striking warning to the architect; though on the other hand, part of the antient wall of Penrith Castle, still standing and in good preservation, shows that even among these justly suspected strata, some portions, either by their freedom from salt, or some other cause, are to be excepted from censure.

RED SEA. This sea resembles in form those large inlets of the ocean which in the mountainous regions of Scotland are called friths and in Norway fiords. It is a portion of the Indian Ocean, with which it is connected by the Gulf of Aden and the strait of Bab-el-Mandeb. [BAB-EL-MANDEB.] It extends from this strait (12° 40′ N. lat.) in a north by west direction to 30° N. lat. It lies between 32° 20′ and 43° 30′ E. long.

The length of this immense inlet is little short of 1400 miles: but the width varies, though in the greatest part of it the variation is not considerable. From the strait of Babel-el-Mandeb, which is only sixteen miles wide, it gradually enlarges; and at the distance of 160 miles from the strait it is 180 miles across: this breadth may be considered as the average width from Ras Essah or the island of Camaran to Jiddah, a distance of nearly 500 miles. Off Jiddah it is not much more than 120 miles wide; and this width continues to Ras Mohammed, south of 28° N. lat., where the sea divides into two arms: this distance considerably exceeds 500 miles. Of the two arms, into which the Red Sea branches off at Ras Mohammed, the eastern is called Bahr-el-Akaba, and the western Bahr-el-Suez, or Kolsum. Between these two gulfs is the mountain-region of Mount Sinai or Jibbel Musa (Mount of Moses). The Bahr-el-Akaba branches off in a north-eastern direction, and extends more than 100 miles, with an average width of less than 15 miles. Near its entrance is the island of Tiran, which is 800 feet above the level of the sea, and between it and the continent are two straits, of which only the western, called the strait of Tiran, is navigable for large vessels. The entrance of the Bahr-el-Suez is called the Straits of Jubal or Jublah, and is about fifteen miles across. The gulf itself runs in a north by west direction to its extremity at the town of Suez, a distance exceeding 180 miles; its average width is twenty miles. The surface of the Red Sea amounts to nearly 180,000 miles, according to an estimate.

The Red Sea is of great depth. The shallowest part is the Gulf of Suez, which in the middle, towards the Straits of Jublah, is from 40 to 50 fathoms deep; farther north its depth decreases to 30 fathoms; and approaching the harbour of Suez, it shoals to 20 fathoms, and by degrees to 3 fathoms, which is the depth of the harbour itself. The Gulf of Akaba varies in its middle part between 100 and 200 fathoms. The main body of the sea is still deeper, and in most parts a bottom cannot be found at the depth of 100 fathoms; in some places it is 230 fathoms deep. Towards the southern extremity, south of 16° N. lat., it grows much shallower, the depth in general not exceeding 40 or 50 fathoms.

This depth of water would be favourable to navigation, as the sea generally shoals to soundings near the shores; but the navigation is rendered difficult by islands, banks, and the prevailing winds. Small rocky islands are tolerably numerous, especially along the eastern shores, but as they usually contain small harbours, they would be rather advantageous were it not for the adjacent reefs. The islands are generally isolated, except between 15° and 17° N. lat., where the group of the Farsan Islands occurs along the eastern shore, and on the western that of the Dhalak Islands, each of which consists of a larger island and a great number of smaller islands, between which there are numerous reefs. South of these groups there are some islands dispersed in the middle of the sea, as Jibbel Teer, the Zebayer Islands (Jezayer es Seba, or the Seven Islands), and others. Two of these islands are volcanic, and on Jibbel Teer there is an active volcano, 900 feet above the sea.

The Red Sea is the most northern portion of the ocean in which coral reefs occur, and they are more numerous than in any other part of the sea of equal extent. They differ in their form from those which are found in the Pacific Ocean, never having a round figure, but almost always extending in a tolerably straight line, and parallel to the coast; the interior is filled up, so that they never contain a lagoon, as is almost invariably the case with those in the Pacific. These coral-reefs are frequently united with the adjacent continents, and render the shores almost inaccessible, as the water near them is very deep, and the reefs themselves have only from 3 to 6 feet water, which gradually shoals on approaching the beach, so that even boats are stopped at the distance of a quarter of a mile from the dry land. The reefs which are unconnected with the shores are still more numerous, and frequently several miles from them. Their edges towards the open sea are very steep, and the sea itself is of great depth. But the edge which is opposite the mainland has usually a gradual and gentle slope, and affords good anchorage to vessels. The sea between this inner edge and the mainland is generally not very deep, and the small vessels of the country navigate these straits in preference to the open sea, as the water is less agitated by the winds, and they are always in the neighbourhood of some place which offers anchorage in case a gale should rise. The winds, which commonly are very strong in the open sea, can hardly be said to extend to these straits, so that small vessels can take advantage of the sea and land breezes, which regularly set in at certain hours of the day, at least during the greatest part of the year. These advantages however are lost by the necessity of putting into some harbour during the night. The isolated small coral-reefs, though numerous, are easily avoided in the day-time, the water of the sea being so clear that they can be distinguished at a great distance. In addition to this, vessels are obliged to follow the shores, which nearly doubles the length of their voyage. The reefs are much more numerous along the Arabian than on the African coast. South of the groups of the Dhalak and Farsan Islands only a few small ones occur on each shore. Both groups are surrounded with and intersected by reefs. North of the Dhalak Islands, as far as the entrance of the Bahr-el-Suez, they are neither large nor numerous, except for several miles south of the harbour of Suakin (near 19° N. lat.), and between Ras Erba (Elba) (22° N. lat.) and Ras Bornass (24° N. lat.), where they are numerous and extensive. In the Strait of Jublah many small ones occur, and several are found in the Bahr-el-Suez. Hardly any reefs occur in the deep inlet called Bahr-el-Akaba, but reefs are numerous in the Straits of Tiran; in fact the eastern strait, which is formed by the island of Tiran, is quite locked up with them. From this point southward to the parallel of Jiddah (21° 30′ N. lat.) the coast is nearly blocked up with them, except between Ras Baredy and the harbour of Yambo. Between Jiddah and 20° N. lat. the Arabian shores are remarkably free from reefs; but from that latitude to the Farsan Islands they are so numerous and large as to render the navigation extremely dangerous.

The reefs are more dangerous to the unwary navigator as a heavy surf is never observed on them, whatever may be the state of wind and weather. Lieutenant Wellsted thinks that the absence of surf may be accounted for by the porous nature of the coral which constitutes the outer part of the reefs, by which the force of the sea is broken in the same manner as that of a body of water would be broken, if dashed against a sieve.

The Red Sea occupies the lowest portion of a deep valley which lies between the elevated table-land of Arabia on the east, and the high lands of Abyssinia, Nubia, and Egypt on the west. The outer edge of these table-lands is generally from 10 to 30 miles from the shores, and has the appearance of a continuous mountain-range, varying in height between 3000 and 6000 feet. These mountains approach much nearer to the shores north of 24° N. lat. than south of that parallel. The space between them and the shores is partly occupied by hills, which skirt the edges of the table-land, and partly by a low and level tract along the sea, which is generally sandy, but sometimes swampy. This tract, as well as the hills between it and the mountains, is far from being sterile, and it has also the advantage of rains in November, December, and January; but it is nearly uncultivated, as the inhabitants, who consist of several tribes of Bedouin Arabs, are averse to industry, and make no other use of these tracts than as pasture-grounds when the grass on the table-land is dried up.

The peculiar position of the sea between two elevated table-lands has a great influence on the direction of the winds. During the warm season, from May to October, northern breezes prevail throughout the whole extent of the sea. They blow not without interruption, but frequently for several days with considerable force. During this period the reefs have about two feet less water on them than in the remaining months of the year, a circumstance which may be attributed to the continual current which at that time sets through the Straits of Bab-el-mandeb into the Gulf of Aden. In the winter, from October to May, northern winds are prevalent in the northern part of the sea; but in the southern, they blow from the south, and generally with great constancy. The currents then change, and flow back with great rapidity; and, as the whole body of water has no means of escaping, it is collected towards the northern parts of the sea, and becomes considerably elevated. As the winds always blow in the direction of the length of the sea, they affect only the open parts, and not the straits between the reefs and the mainland, in which, as already observed, a regular change of land and sea breezes prevails.

The principal harbours on the Arabian shores are Mokha, Hodeidah, and Jiddah; and on the African, Suez, Cosseir or Cosire, Suakin, and Massowah. There is a pretty active communication kept up between these places, especially by the numerous pilgrims who visit Mecca and Medina from the eastern countries of Africa. The country vessels bound from Cosire to Jiddah cross the sea to the nearest point of the opposite coast, and then sail along shore to Jiddah. Those from Jiddah to Cosire follow the coast as far north as Moilah, or Râs Mohammed, and cross from thence with the northerly winds. Ships bound from Suakin to Jiddah proceed along shore as far as Salakah (20° 30′ N. lat.), and thence stretch across the sea to Jiddah. When they are bound from Suakin to Mokha, they generally proceed southward along the African coast till they reach Massowah, whence they cross over to the Arabian shore. These vessels, perhaps exceeding four hundred in number, are of various descriptions, and most of them are between 50 and 200 tons burden. The greater number are employed in the transport of pilgrims, whose number annually exceeds 20,000; and of grain and slaves, which constitute nearly the whole of the exports from Africa to Arabia. As Arabia does not produce sufficient supplies for the pilgrims who visit Mecca, and annually amount to above 120,000 individuals, the transport of grain from Cosire to Jiddah employs a great number of vessels. The grain is procured from Upper Egypt; and after being collected in the granaries of Kenneh, is forwarded by camels to Cosire. This trade is now carried on entirely on account of the pasha of Egypt. Hardly any merchandise is brought from Suakin and Massowah to Arabia, except slaves.

As the countries along the shores of the Red Sea do not produce many articles of export, they are not much visited by foreign vessels. The few which navigate this sea go to Mokha and Jiddah. They come from the Persian Gulf, Hindustan, and the Indian Archipelago. The vessels from Basra and Abu-shehr import wheat, tobacco, dates from Basra and the Bahrein Islands, and Persian carpets, which are mostly purchased by the Bedouin sheikhs: they bring also some rich pilgrims from Persia. From Calcutta, and occasionally from Bombay, are brought rice, sugar, and Dacca muslins: also coarse and fine blue cloths, cambric, and indigo; with teak timber, palm-oil, cocoa-nuts, and the spices of the coast of Malabar. The vessels from the Indian Archipelago bring spices (especially those of Malabar), rice, and a number of young females, who are sold to the Turks at the price of 150 to 300 dollars. Besides this commerce, which is carried on in square-rigged vessels, a considerable number of large bagalos from Hindustan, especially from Mandaree in Kutch, bring to Arabia the produce of India. The returns for the foreign goods imported into Jiddah are generally cash, which is brought by the pilgrims, to whom nearly all the goods are sold; but coffee, Arabic gum, myrrh, and frankincense are exported from Mokha. The coffee grows on the hilly declivity of the table-land north of Mokha; but the other three articles are imported from Africa, where they are collected in the countries along the southern shores of the Gulf of Aden, and in the vicinity of Cape Guardafui.

The first mention of the Red Sea occurs in the Bible, on the occasion of the Israelites passing through it. Soon after that time, if not before, it seems to have been navigated. In the time of Solomon the advantages of such a navigation were well understood; for after the conquest of Idumæa by David, and the acquisition of the country near the Bahr el Akaba, Solomon established at Elath and Ezion Geber, on the shores of that gulf, a colony of Phœnician navigators. It is however uncertain if the navigation then extended to India. According to the authority of several Greek authors, the most antient intercourse between India and the countries on the Mediterranean was carried on by means of the Persian Gulf. Modern writers have had some doubt of this fact, on account of the difficulty of transporting the goods through that extensive desert which intervenes between El Katif, the supposed emporium on the Persian Gulf, and the Mediterranean. But this doubt has been removed, since it has been discovered, in the course of the wars of the pasha of Egypt with the Wehabites, that a series of extensive oases stretch across the Arabian peninsula between 24° and 26° N. lat.; and that through the western of these oases the road passes by which the haji, or caravan of pilgrims, passes from Damascus to Medina. This route seems to have been the most frequented up to the time of Alexander. It is however probable that before his time some connection existed between the Red Sea and India, though it was not the most common channel by which the exports of India reached the Mediterranean. But when the wars subsequent to the death of Alexander rendered the transport of commodities through Syria dangerous, and the policy of the kings of Egypt favoured the navigation and commerce of the Red Sea, it became soon the principal channel of commerce between Europe and India. This intercourse continually increased, though slowly, as the exports of India at that time consisted only of articles which were consumed by the rich. But in the first century of the Christian æra the trade was so considerable, that, according to Strabo, 120 vessels annually departed from Myos Hormos to India. The true situation of that harbour is not known, but it is supposed to be near 25° N. lat. The conquest of Egypt by the Arabian khalifs, in the seventh century, does not seem to have diminished the intercourse between the two countries, as it is certain that in the ninth century the Arabs extended their navigation from the Red Sea through the Indian Ocean to Canton in China. Soon after that time the Venetians established factories in Alexandria; and the goods of India passed by the Red Sea to that town, and thence to Europe, during the period between the twelfth and fifteenth centuries, until the discovery of the route round the Cape of Good Hope directed the whole commerce of India into a different channel. The commerce and navigation of the Red Sea were nearly annihilated by this event, and recovered only a little in the seventeenth century, owing to the cultivation of coffee in the southern districts of Arabia. It has recently somewhat increased, mainly in consequence of the tranquil condition of Egypt under Mohammed Ali and his authority among the Bedouin tribes which inhabit the Arabian coast. In addition to this, steam-boats from India have recently navigated the sea as far north as Suez, and thus a much shorter communication between Europe and India has been established. But the progress of the steam-boats is slow, on account of the heavy gales which blow, with short intermissions, in the northern part of the sea. It has therefore been proposed to employ only small steam-vessels, so that when impeded in their course by these gales, they may, like the Arabian vessels, sail in the narrow straits between the Arabian coast and the reefs. We do not know if this plan has been adopted.

The name Red Sea is a translation of the Latin Rubrum Mare, and the Greek term ('Ερυϑρὰ ϑάλασσα) used by Strabo. Herodotus calls the Red Sea the Arabian Gulf, and also includes it in the general term of Erythræan Sea, which comprises the Indian Ocean and the Persian Gulf.

(Lord Valentia's *Voyages and Travels to India, Ceylon, the Red Sea, &c.*; Burckhardt's *Travels in Nubia*; Rüppel's *Reise in Abyssinia*; Wellsted's *Observation on the Coast of Arabia, &c.*, and *Notice of the Ruins of Berenice*, in 'London Geog. Journal,' vol. vi.; Burnes and Dickinson, *On the Maritime Communication of India*, in 'London Geog. Journal,' vol. vi.; Ehrenberg, *Ueber die Natur und Bildung der Coralleninseln, &c. im Rothen Meere*; *Chart of the Red Sea, according to the Survey of Elvc., Pinching, and Moresby*, by Carless.)

REDAN is the simplest kind of work employed in field fortification, and it consists generally of a parapet of earth, divided on the plan into two faces, which make with one another a salient angle, or one whose vertex is towards the enemy. Existing alone, the work is capable of making but a feeble defence, since its faces are not defended by any flanking fire; and, being open at the gorge or rear, the enemy may easily enter it in that direction. It can therefore be of use only at an outpost, to afford a momentary cover for troops who are to retire when a superior force advances against them. A redan may however be advantageously placed to cover the head of a bridge, the entrance into a village, or defend the ground in front of some strong redoubt; a series of them may also be constructed along the front of an army, in order to strengthen the position and cover the artillery; and, in all these situations, the defects above mentioned cease to exist, since in the first case the gorge is protected by the river, and in the others the faces and gorges are defended by the works or by the troops in the rear.

When it is required to defend any pass immediately on the right or left of redans, flanks, making salient angles with the faces at points near the extremities of the latter, are given to them, so that they then become what are also called bastions or lunettes; and the necessity of having a crossing fire for the defence of the ground in front, when the redans are not flanked by other works, has at times induced engineers to break the lines of parapet near the gorges, so as to form re entering bends, and thus constitute a wing on each side at a right angle with the face.

Among the works constructed, in 1810, for the defence of Lisbon, redans were frequently placed on projecting knolls, in front of the great redoubts, in order to flank the ground which was unseen from the latter: their gorges were protected by palisades, or by parapets, sufficiently slender to have been demolished by the artillery of the principal work, had the enemy succeeded in capturing them; and good communications, covered by the inequalities of the ground, or by earth purposely thrown up, were formed in order to allow the defenders, if necessary, to retire in security. The strong stone windmills, which in that country are often built on salient knolls of ground, were occasionally covered by redans of earth; and thus were formed good defensive posts, to each of which the mill served as a reduit or keep. During the struggle in the south of France, in 1813, Marshal Soult caused redans to be constructed as outworks, one below another, on the descending tongues of land which project from the main chains of heights whose summits he had crowned by strong redoubts.

Two redans connected together, so as to leave one re-entering angle in front, form a queue d'hyronde; and the name of bonnet de prêtre has been sometimes applied to a work consisting of three redans so placed.

REDEMPTION. [Atonement.]

REDEMPTION, EQUITY OF. [Mortgage.]

REDI, FRANCESCO, born at Arezzo in 1626, studied at Florence and Pisa, and took his degree of M.D. in the last-named university. He afterwards proceeded to Rome and Naples, where he applied himself to the study of natural history, and made several curious physiological experiments. On his return to Tuscany, he practised medicine with great reputation, and wrote several works concerning that science. Redi was also a poet, and wrote a dithyramb, 'Bacco in Toscana,' in which he extols the various produce of the Tuscan vineyards: it is a splendid specimen of that species of composition. His other works are:—1, 'Esperienze intorno alla Generazione degli Insetti,' Florence, 1668; 2, 'Osservazioni intorno alle Vipere,' 1664; 3, 'Esperienze intorno a diverse Cose Naturali, particolarmente a quelle che ci sono portate dall' Indie,' 1671, 4to.; 'Osservazioni intorno agli Animali viventi che si trovano negli Animali viventi,' 1684; 5, 'Lettera intorno all' Invenzione degli Occhioli,' 1678: 6, 'Consulti Medici,' 1726-9. 7, 'Lettere Familiari,' 1724-7; 8, 'Sonetti' and other poetry. There are some other of his minor works inserted in the general collection, 'Opere di Francesco Redi,' 3 vols. 4to., Venice, 1712. Redi was a most correct and elegant Italian writer, and also one of the most learned men of his age and country. He was a great favourite with the court of Tuscany, and was physician to the grand-duke Ferdinand II. Redi died at Pisa, in 1698.

RE'DON. [Ille et Vilaine.]

REDONDA. [Montserrat.]

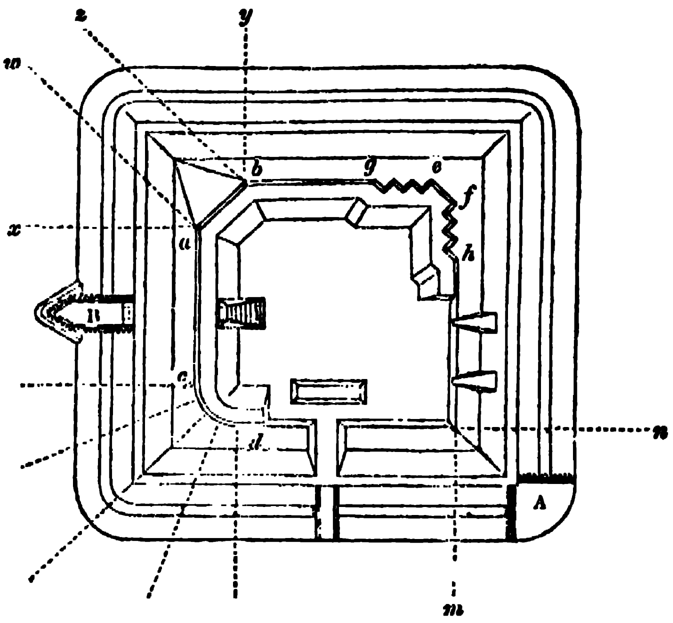
REDOUBT is a general name for nearly every kind of work in the class of field fortifications; thus a redan with flanks, a parapet enclosing a square or polygonal area, a work in the form of a star [Star-fort], and a fort with bastions at the angles, like the enceinte of a fortress, are occasionally so called; but the second of these is the work to which the term is more particularly applied, and it is that which we purpose now to describe.

When a work to be constructed on level ground is intended to contain troops and artillery for the purpose of preventing the enemy from occupying the spot, and when there is an equal probability that the work may be attacked on any side, that spot should be quite enclosed by the parapet; also if the defence is to continue only till succour can arrive from the army in the vicinity, flanking defences being then scarcely necessary, a quadrangular figure may suffice for the plan of the work, and there can be no reason why one side should be longer than another, or why the sides should form with each other any but right angles. But when the redoubt is to occupy an eminence whose figure on the plan is irregular, the faces of the work, whatever be the form thus produced, must necessarily be traced so as to correspond to the different directions assumed by the brow of the height; and if the fire of the work is intended to defend some fixed object, as a pass leading towards it, one of the faces must be perpendicular to the direction of that pass. It may be observed however that in general the number of faces, though not less than four, should be as few as possible. The ditches of all polygonal works without re-entering angles, are incapable of being defended by the fire from the parapets above, on account of the height and thickness of the latter, which prevent the soldiers from seeing them; and a curvilinear redoubt has, besides, two defects which are irremediable; the fires from its parapets are diverging, therefore they produce little effect while the enemy is advancing up to the work; and the ditch, on account of its form, is incapable of being defended from stockades within it. These objections apply with nearly equal force to redoubts formed on regular polygons of more than five or six sides. The French however made a circular redoubt of casks for the purpose of strengthening the defence of the isthmus at St. Sebastian previously to the siege of that place in 1813; and circular redoubts of masonry are supposed to be useful on the seacoasts. In the latter situation they are not liable to be attacked by infantry; and their artillery, which is mounted on traversing platforms, may be fired in any direction against ships or boats, should an enemy attempt a debarkation of troops. [Martello Towers.]

Every work in field as well as in permanent fortification is surrounded by a ditch, from whence is obtained the earth for the parapet, and by which the difficulty of carrying it by assault is increased. The ditch is generally crossed directly opposite the entrance by a bridge of timber, which should be capable of being drawn into the work, or re-placed at pleasure. The entrance into a redoubt is at a re-entering angle, if there is one, otherwise it may be about the middle of one of the faces on the side which is least exposed to the view of the enemy; and, besides being barricaded, it is defended by the fire from a traverse, which is raised in the interior, and perpendicular to the direction of the passage.

Redoubts for the defence of positions are in general intended to contain only about fifty men with three guns; but works in the form of irregular polygons have sometimes been constructed of a magnitude sufficient to contain 1600 men and twenty-five pieces of artillery; and such were the two principal redoubts (on Mount Agraça and at Torres Vedras), formed in 1810, in order to protect Lisbon. These were expected to make a vigorous defence in the event of being attacked; but it is admitted that their *trace*, or ground-plan, was defective on account of the want of flanks, and perhaps they would have been prevented from falling only by the strong divisions of troops who were daily under arms in their vicinity. The redoubt constructed by the British in the neighbourhood of Toulon, in 1793, for the protection of the town and fleet, was a large work well furnished with artillery; yet, on being attacked by the republican troops, it was taken, after a gallant resistance, in which the enemy was twice repulsed. The ditches being undefended by flanks, the assailants, on being driven into them, re-formed their order with little molestation; and at the third attack they succeeded in getting possession of the work.

It is admitted among military men that in firing over a parapet, the soldier doing the duty as rapidly as possible, and fearing to expose himself while adjusting his musket, places the latter mechanically in a direction nearly perpendicular to the line of the face behind which he is stationed. It follows that in front of every salient angle of the work there must be an undefended sectoral space, as *mn*, in the subjoined cut, which represents the plan of a square redoubt, in which space, in order to avoid the direct fire from the faces, the enemy may advance to the attack; and on this account it is recommended that the faces of the work should be disposed so that the angles may be turned towards ground which is impassable, or which will not permit the enemy to establish batteries for the purpose of enfilading those faces. When this disposition is not possible, various methods may be adopted by which the troops who man the work might direct some of their fire within those sectors. The simplest of these, and that which is generally put in practice, is to form the crest of the parapet near the angle, perpendicularly to the *capital* (the line bisecting the angle) as at *ab*; by which means the space between *w* and *z* may be directly defended, and the sectors *xw* and *zy* being small,



very little attention on the part of the men about *a* and *b* will enable them to give their muskets an oblique direction so as to fire upon an enemy advancing within those spaces. A second method is that of rounding off the interior of the parapet at the angles, as at *cd*; but this has been objected to on account of the divergency of the lines of fire. The third method, which is much dwelt on by writers on fortification, consists in forming the interior of the parapet with indentations, as at *cg* and *fh*, alternately parallel and perpendicular to the capital, each indent being three feet long; and a parapet of this kind is said to be *en cremaillère*. It is evident that by placing men contiguously to the sides of these indentations, a fire may be kept up in either of the directions just mentioned; and by placing them at the angles, they may fire perpendicularly to the general face of the work. It must be observed however that the men cannot fire in these different directions at the same time, because, the muskets crossing one another, that of one man might be injured by the fire of the next. The only objections to this method are, that the parapet can be so formed only by men belonging to the corps of sappers and miners, who are regularly trained to the construction of fortifications, but who may not be present when wanted; and that the unsteadiness of the soldiers in firing almost always renders such precision in the formation of the work useless.

The ditch of a redoubt having no flanks, being unseen and incapable of defence from the parapets, it has been proposed, in order to have some means of annoying the enemy when in the ditch, to form an enclosed space A, at one or more of the angles of the ditch, by planting a line of palisades across the latter on two contiguous faces of the work; the enclosure may have a roof of timber covered with earth, and loop-holes, three feet asunder, must be cut in the palisades, that the defenders may be enabled to fire along the ditches.

Another method, which may be advantageously adopted when a face of the work has considerable length, is to form, as at B, what is called a palisade caponnière, by planting across the ditch, at the middle of the face, two rows of palisades about eight feet asunder; each row being pierced with loop-holes. The entrance into the caponniere is by steps in the interior of the redoubt and a gallery under its parapet; and this work, as well as that at A, may have a roof, but in no case should such roof be above the level of the natural ground, in order that it may be concealed as long as possible from the view of the enemy. One of the redoubts which was executed near Lisbon, being commanded by a height in its front, from whence the parapets might have been destroyed and the interior ploughed by shot, there was formed a gallery behind the counterscarp, and opposite one of the angles of the work, with loop-holes, from whence the ditch along each face might have been defended by musketry if the enemy had penetrated into it. The soil being chalk, no timber-frames were necessary for the support of the sides or top; and between this recess and the interior of the redoubt there was a gallery of communication passing under the bottom of the ditch.

A row of palisades is frequently planted quite along the ditch of a redoubt. Sometimes also the escarp of the work is fraized, or furnished with palisades planted in an inclined position, and a line of chevaux-de frize is disposed upon the berme. In order to retard the advance of an enemy, the work is generally surrounded, at a distance not exceeding the range of musket-shot, by a single or double abatis, and often by two rows of pits called *trous de loup*.

The magnitude of a redoubt, whatever be its form, is determined by the strength of the garrison and the quantity of ordnance by which it is to be defended; all the men being supposed to be lodged within it. It was formerly the practice to allow on the area of the terreplein, within the foot of the banquette, ten square feet for each man, and 324 square feet for each piece of artillery; consequently when the redoubt is of a square form, the breadth of the banquette being known (about 11 feet), the length of the crest-line on each face could be easily determined. In order that the defenders may conveniently use their arms on the banquette, it has been customary to allow three feet along the crest of the parapet for each man, who is to stand contiguously to the interior slope; and it was once considered that a redoubt intended to make a considerable resistance when attacked on all sides, would be adequately garrisoned if the number of men in it were equal to the number of feet in the whole length of the crest of the parapet; that is to say, if there were three ranks of men along each face, the work being supposed to be capable of containing such a number. It is said that each side of the square redoubts which Marshal Saxe caused to be constructed at the siege of Maestricht in 1748 was above 100 feet long, measured on the crest of the parapet, and that each redoubt was garrisoned by 500 men; and it will be found by computation that, consistently with the above rules, a square redoubt, each of whose faces is sixteen yards long, is the least that ought to be constructed; for if less, the interior within the banquette would not contain the number of men necessary to line its parapet with one rank. But the rule relating to the area within the banquette has been objected to as an unnecessary affectation of mathematical precision. The British engineers who constructed the works for the protection of Lisbon observe that, except at night, or at the moment of being attacked, part of the garrison will be on watch, or otherwise occupied outside of the work; and even at those times, at least one-third will be under arms on the banquette. Colonel Sir John Jones states that the strengths of the garrison were finally determined by allowing two men per yard in the length of the parapet for the exterior works, and one man per yard for the interior works; deductions being made for the spaces where artillery was to stand. Each gun takes up about eighteen feet of the length of a parapet.

The crest of the parapet of a redoubt may be about 8 feet above the natural ground, unless the work is to be defiladed from some commanding ground in the neighbourhood, in which case it must be higher. The form of a section or profile of the parapet is similar to that which is used for permanent fortification [Lines of Intrenchment, *fig*. 4], but the breadth of the superior slope may vary with the nature of the arm which the enemy can bring against it; three feet will suffice if the work can be attacked by infantry only, but it may be as much as 10 or 12 feet if it is to resist field artillery of the heaviest calibre. The superior surface of the parapet should slope down towards the exterior, so that the defenders may see the top of the counterscarp of the ditch in front; and when, from the great relief of the work, this is impossible, the counterscarp should be raised by earth obtained from the ditch to the height necessary for this purpose; taking care however to give the raised earth a gentle slope towards the exterior, that the enemy may not be screened by it. The exterior of the parapet and the escarp of the ditch are covered or reveted with sods when the earth has not sufficient tenacity to stand unsupported; and when the work is to resist the fire of heavy artillery, the revetment might consist of stout logs of timber planted obliquely in the ground or in the bottom of the ditch, and leaning against the face of the work. The interior of the parapet is usually reveted with sods or fascines.

Redoubts are intended to fortify military positions, for which purpose they usually occupy the heights and command the defiles; and their magnitude or number must depend upon the time afforded for their construction. [LINES OF INTRENCHMENT; MILITARY POSITIONS.] It sometimes happens that they are thrown up during a night to protect artillery on the wings, or in some important situation in front of the army, in expectation of an engagement taking place the next day; and then they are necessarily few and small. When Marshal Soult was reduced to defensive operations in the south of France, in 1813 and 1814, he strongly entrenched the heights on all the frontier between the sea about Bayonne and St. Jean-de-Luz, and the mountains at St. Jean-Pied-de-Port; an extent of above 16 miles. The works, which were executed in three months, were generally irregular polygons; and some of them were constructed for 500 men. More than a year was spent in raising the redoubts which covered Lisbon; and consequently these were not only strong, but numerous beyond any other example. [ENCAMPMENT.] They were of every trace, but mostly irregular polygons, whose sides sometimes formed re-entering angles, as the ground required: the two great redoubts before mentioned were retrenched by interior parapets, which also served as traverses, and each salient point of the redoubt at Torres Vedras constituted an independent post.

Attack and Defence of a Redoubt.—In the attack of a small redoubt unprovided with artillery, light infantry or riflemen, keeping for a time as much as possible covered by the inequalities of the ground, endeavour to surround the work, and, by a fire of musketry, directed towards the crest of the parapet, to diminish that of the defenders. The assailing troops then gradually close in upon the redoubt, and, while one division remains on the counterscarp to continue the fire, should the defenders show themselves upon the parapets, the rest descend into the ditch, where, having collected themselves in parties or small columns, they mount the parapet on each side of a salient angle; then developing themselves on the summit, they make a general discharge and enter the work. In order to avoid accidents in descending into the ditch, or in ascending the escarp, it is recommended that the bayonets should not be fixed by the assailants till they have gained the berme of the work.

But if the redoubt is of considerable magnitude, if it is furnished with artillery, and moreover protected by palisades in the ditches, and abatis or other obstacles in the front, the attack must be conducted with more powerful means. It should commence by a fire of artillery directed partly so as to enfilade the parapets, break down the palisades and derange the abatis, and partly to destroy the merlons which cover the artillery of the work. The fire of the latter being thus in some measure silenced, the light infantry, as in the former case, endeavour by musketry to prevent the defenders from manning the parapets; and in the mean time columns of troops advance towards the angles, being preceded by parties of sappers and miners, who make openings for them in the line of abatis, or cover with timbers the trous de loup, if such there be. If the ditch is deep, the descent into it, and the subsequent ascent of the escarp, must be facilitated either by placing scaling-ladders or by throwing in fascines or bags of hay; and any palisades or other obstacles which may not have been displaced by the artillery, must now be cleared away by the working-parties which accompany the troops. The fire of the covering parties must cease while the assailants are mounting the parapet, but it must recommence if they should be repelled: in the latter case the storming troops reform their order in the ditch, and again attempt to enter the work. It may be supposed that at length they will succeed, when the defenders, if not provided with a redoubt to which they may retire for the purpose of capitulating, must surrender at discretion. In 1793 the French camp under Valenciennes was protected by works which, though furnished with artillery, were open at the gorge; and in an attack, the British cavalry, having entered those works at their rear, made prisoners of all the defenders.

When a redoubt is threatened with an attack, the officer commanding it endeavours to provide against the event by disposing in front of the work all possible obstacles to the advance of the enemy, and by placing sand-bags on the parapets in order to cover the defenders, who are to fire through small intervals left for the purpose: these measures should be taken, if not before, during the night preceding the attack; since the latter generally takes place early in the morning. On the advance of the assailants, the artillery of the work is made to play upon their columns; and the fire of musketry commences as soon as the latter are within the proper range. These fires are kept up vigorously while the assailants are clearing away the obstacles, and until they have descended into the ditch. Should the work have flanks, and the guns behind them be not dismounted, a fire of grape-shot and of musketry must now be directed along the ditches; while hand-grenades and stones are thrown, and live shells are rolled into them from the parapets of the faces. The storming troops may however persevere, and may at length mount upon the parapet, in which case they must be received by a fire of musketry from the defenders on the terreplein; and the latter, if overpowered, must endeavour to retire or capitulate.

Any works constructed within others, in order to prolong their defence, or to afford a retreat for the troops who occupy them, are also called redoubts; but by the French engineers, reduits or retrenchments. [RETRENCHMENT; BLOCKHOUSE.]

REDRUTH, an unincorporated market-town in the hundred of Penwith, in the county of Cornwall, 268 miles from the General Post-office, London, by the Southampton railroad to the Andover-road station (55 miles), and from thence by Andover, Salisbury, Dorchester, Bridport, Exeter, Launceston, Bodmin, and Truro. It is supposed to be a very old town; the original name was Dredruith, interpreted to mean Druids' town; but it did not possess any importance till modern times, when its copper-mines have given it wealth and population.

The area of the parish is 3770 acres. The population, in 1831, was 8191. The town stands on the brow of a hill, and consists for the most part of one long street, running north-east and south-west, indifferently paved, and lighted with gas. The church, dedicated to St. Uny, is about half a mile south-west of the town; it was rebuilt A.D. 1770. There are the remains of an antient chapel in the town, and there are meeting-houses for Baptists, Quakers, and Primitive and Wesleyan Methodists. There are a market-house, shambles, a small theatre, and a spacious handsome savings' bank, which, there being no town-hall, is used upon the revision of lists of county voters and for other public purposes. Near the entrance to the market-place is a clock-tower with an illuminated clock.

The wealth of the town is derived from the valuable tin and copper mines in this and the adjacent parishes. There are weekly sales of copper-ore, and stores of such articles as the miners require are kept in the town. There are two weekly markets; the Friday market is a considerable corn-market; there are three yearly fairs, chiefly for cattle.

The living is a rectory, in the archdeaconry of Cornwall and diocese of Exeter, of the clear yearly value of 432*l*., with a glebe-house. There were, in 1833, one infant-school, with 154 children of both sexes; seventeen day-schools, with 372 male and 190 female scholars; and three Sunday schools, with 394 male and 301 female scholars. There is a subscription reading-room.

There are several villages in the parish; at one of them, called Plaingwary (that is, in Cornish, plân an guare, the plain of sport or pastime), are the remains of one of the 'rounds' in which plays were antiently performed. These rounds are described in the article CORNWALL [vol. viii., p. 38].

The Redruth and Chasewater (or, as it is more commonly called, Redruth and Deveron) railway extends from Redruth to Deveron, a shipping-place, on a creek running up from Falmouth harbour. It traverses the great mining parish of Gwennap, and communicates by branches with other mining districts, and also with Portreath, a seaport on the North Channel. The carriages are drawn by horses, at a rate of three or four miles per hour. This railway is used chiefly for the conveyance of ores from the mines to the places of shipment; coals, timber, &c. from the wharfs to the mines; and flour and merchandise to Redruth and the intervening villages. By means of a short branch it joins the railway from Redruth to Hayle, the waggons or carriages being loaded and unloaded from one railway to the other. The length of the main line is about fourteen miles. This railway, which was formed under an Act passed in 1824, has been open about fifteen years, and has proved very profitable.

The Hayle railway, which was also constructed by a joint-stock company, under Acts obtained in 1834 and 1836, affords communication by its main line between the town of Redruth, the adjacent mines, and the port of Hayle, its extreme length being about twelve miles. It has several branches, the principal of which is about three miles and a half in extent, and communicates with the seaport of Portreath. The line is worked by locomotive and stationary steam-engines, at a speed of from twelve to twenty miles an hour, the latter being used in some parts on account of the steepness of the inclined planes. The traffic is of much the same description as that on the Redruth and Deveron railway, and a large quantity of general merchandise is conveyed inland, which is brought by a steamer that plies between the ports of Hayle and Bristol. This railway (on which no passengers are conveyed) has been open about three years, but has not hitherto realised the expectations of its projectors.

REDSTART. [Sylviadæ.]

REDU'CTIO AD ABSURDUM. [Absurdum, Reductio ad.]

REDUCTION. This term is used in arithmetic in the well-known sense of the operation of turning one denomination of weights or measures into another; thus shillings may be reduced to pounds, or pounds to shillings. It is also used in the same sense throughout analysis, namely, that of bringing one form into another, making one question depend upon another, &c.; in fact, for transformation generally. It were to be wished that the latter word transformation should take its place whenever the two forms are of equal difficulty or the two questions of the same character, &c., and that reduction should be employed only when there is really a reduction, that is, a bringing down either of dimension or difficulty, &c. Many writers do use the word thus, and thus only, but others do not.

REDUCTION INTO POSSESSION. [Possession.]

REEFS, or CORAL REEFS, are a peculiar kind of rock which occurs abundantly in some parts of the ocean. They differ from other rocks in extending over a considerable space of the sea in length, with a very narrow width. Generally they are also only a few feet below water; so that on the side where they are washed by the open sea, a heavy surf is continually running against them.

Reefs appear under various forms. In some places they are contiguous to the shores, as in the Red Sea; in others they fringe the shores, being separated from them by a narrow channel of moderate depth. Sometimes they surround islands at a considerable distance from the shores, and the islands so encircled are almost without exception of volcanic origin. Very frequently they surround a portion of the sea, within which there are some small islands, which are often contiguous to the reefs, and seem to be a part of them, as both are composed of the same material. There are also coral reefs at a great distance from the land, which run nearly parallel to it, like a barrier. Among the latter are those of the Coral Sea, along the eastern coast of Australia. [Pacific.]

The attention of navigators and naturalists was first attracted to those islands which go under the name of Lagoon Islands. A reef approaching in form to a circle surrounds a part of the sea and forms a lagoon, on the inner part of which there are usually several smaller islands, wooded and inhabited, which are contiguous to the reefs themselves, and frequently extend along them with little interruption. The water on the outside is always nearly unfathomable, but within the reefs good anchorage is generally found, and the reefs themselves have one or more openings of deep water, by which the largest vessels may enter the lagoon. Accurate observers soon discovered that the reefs were composed of coral, and were the production of an animal. On these circumstances the first theory of reefs was founded. This theory received some addition from Forster, who accompanied Captain Cook on his second voyage. According to him, they are raised by these small animals perpendicularly like a wall, from a great depth to a very small distance from the surface of the sea. The waves afterwards bring sand, muscles, tang, and pieces of coral, and deposit them on the reef, which, in this way, is gradually raised above the sea-level, and becomes fit for vegetation. Currents and sea-fowls bring the seeds of marine plants, which, being decomposed, form a mould on which the cocoa-nut palm, when carried thither by the waves, thrives luxuriantly. This theory of Forster was adopted and extended by Flinders, who in surveying the coasts of Australia had abundant opportunities of observing the formation of these islands; and still more by Peron and Chamisso. The last-mentioned naturalist accompanied Kotzebue on his first voyage of discovery (1815-1818).

But facts have since been observed by Quoy and Gaimard, who accompanied Freycinet on his voyage, and published their observations in the 'Annales des Sciences Naturelles,' which are inconsistent with this theory. They found that the reefs did not entirely consist of coral, and that the layer of coral hardly exceeded a few fathoms in depth. Besides this the polypiaria which are able to form such a layer do not inhabit the sea to any great depth, and are not found where the water is more than 30 feet deep. They therefore supposed that these animals executed their work only in those parts of the sea where the bottom had been raised by some natural cause nearly to the surface of the water. They supported their theory by adducing the fact that the continuity of every lagoon-reef was broken at one or more places, so as to constitute a strait of very deep water, which could not be the case if these works were carried on at a depth of from 100 to 200 fathoms. This theory coincides with the views adopted by Von Buch, in his description of the Canary Islands, and has been adopted by Ehrenberg, in his pamphlet 'Ueber die Natur und Bildung der Coralleninseln und Corallenbanke im rothen Meere;' and by Darwin, in the third volume of the 'Surveying Voyages of the Adventure and Beagle.' The last-mentioned writer however does not doubt that the reefs which form the lagoon islands are composed of coral to a great depth, much greater indeed than those polypiaria which form them can live in. He explains this in a very ingenious way, by supposing that they formerly had an elevated island in the middle, but that in those portions of the sea where they now occur, the bottom of the waters was gradually lowered by subsidence, by which the polypiaria were enabled to continue their work farther, and the mountainous islands in the middle disappeared. In other parts of the Pacific and Indian oceans the contrary is supposed to have taken place: the bottom of the sea was elevated, and in these tracts volcanic islands occur. He observes that in this respect these seas may be divided into broad bands, in which an elevation and submersion has alternately taken place; and he draws from it some important inferences (p. 562-569).

REFLECTION. [Optics.]

REFLECTING INSTRUMENTS, viz., reflecting circle and sextant. [Sextant.]

REFLECTING TELESCOPE. [Telescope.]

REFORMATION is the name generally given to the great schism which took place in the Western Church in the first half of the sixteenth century, and by which about one-fourth of the population of Europe has become separated from the Church of Rome. The countries in which the doctrines of the Reformation have become predominant, being the creed of the great majority of the people, are Sweden, Denmark, Norway, England, Scotland, the kingdom of Prussia, the kingdoms of the Netherlands, Hanover, Saxony, Würtemberg, the electorate of Hesse Cassel, the grand-duchies of Hesse Darmstadt and Mecklenburg; the land-graviat of Hesse Homburg, the duchies of Nassau and Brunswick; the principalities of Anhalt, Lippe, and some others; the free towns of Hamburg, Bremen, Frankfort, and Lübeck; the Russian Baltic provinces of Livonia, Esthonia, Courland, and Finnland; the Swiss cantons of Bern, Zürich, Basle, Schaffhausen, Aargau, Thurgau, Grisons, Vaud, Glarus, Appenzell, Neuchatel, and Geneva. The countries in which the reformed doctrines are followed by part, but not the majority of the population, are Hungary, Transylvania, the grand-duchy of Baden and some minor German states, France, the Swiss canton of St. Gall, and Ireland. Besides these, the great majority of the people of the United States of North America, as well as of the English and Dutch colonies, follow the same mode of faith.

In order to understand correctly the history of the Reformation, it is necessary to be acquainted with the social, political, and intellectual state of Europe in the fifteenth century; and for this purpose the histories of the Councils of Constance and of Basle, and the 'Historia Bohemica,' by Æneas Sylvius Piccolomini, are of great service. [Pius II.] Previous to the Reformation, the see of Rome claimed of divine right, and asserted, with the assistance of the lay power of the various states of Europe, an absolute authority over the whole Christian Church, and consequently over the population of all Europe, with the exception of the provinces of the Turkish empire, the dominions of the czar of Russia, and of part of Poland, where the Eastern or

Greek church was established. By virtue of this supreme authority, the Roman pontiff decided absolutely all doubts and disputes which might arise, whether in matters of doctrine, jurisdiction, or discipline: his decisions were considered as infallible; and whoever resisted or gainsayed them was considered a heretic, and as such liable to canonical censures, and also to the temporal penalties awarded by the canon law against heretics. The government of the church was therefore absolute; and the church, or rather, the bishop of Rome, as head of the church, assumed also a supremacy even in temporal matters, although the exercise of this last supremacy was resisted by various princes. [GREGORY VII.; INNOCENT III.; INNOCENT IV.; GREGORY IX.]

The great object of the reformers of the sixteenth century was to overthrow the principle of absolutism in the government of the church, by contesting the infallibility and supremacy of the bishop of Rome. This had been already contested, and indeed set aside by the Councils of Constance and of Basle; but the point of contention had never been finally and permanently settled. [POPE.] The reformers of the sixteenth century however went much farther; they denied the absolute authority even of the councils, and they leaned towards the popular or democratic principle in religious matters, by allowing the right of individual interpretation of the Scriptures, and discarding all tradition and human authority in matters of faith. And here it must be observed that previous to the sixteenth century several of the most strenuous opposers of Roman absolutism in matters of jurisdiction and discipline, such as Gerson, chancellor of the university of Paris, in his work, 'De Modis uniendi et reformandi Ecclesiam in Concilio Universali,' never questioned the right of the church in council assembled to decide upon matters of doctrine, and to enforce decision against all dissenters even by means of temporal penalties. In his letter to the archbishop of Prague, on the Hussite controversy, which is given by Cochlæus, 'Historia Hussitarum' (lib. i.), Gerson recommends the axe and the stake as the last effectual means of extirpating heresy: 'Superest igitur, velut in desperata peste, securis brachii secularis, excidens hæreses cum auctoribus suis, et in ignem mittens. Providens hac tanta severitate et misericordi, ut sic dicatur, crudelitate, ne sermo talium, veluti cancer, serpat in perniciem tam propriam quam alienam.' This spirit of intolerance is therefore not peculiar to the Roman see, but is a consequence of the absolute principle of the Latin or Roman Catholic church. In our own times, Llorente, the historian of the Inquisition, whilst censuring the practice of that tribunal, which he considers as illegal, thinks it proper that the respective bishops should prosecute heretics; and the Spanish Cortes of 1812, when they abolished the court of the Holy Office, stated, as one of their reasons, that the diocesan courts were the proper authority for prosecuting and repressing heresy. But the reformers of the sixteenth century denied this absolute authority of church, council, or bishop, and as in the course of their struggle they were met by several dogmas or doctrinal tenets derived either from passages of the Scriptures as interpreted by the Roman church, or from tradition, or from decisions of the councils or decretals of the popes, which were urged in opposition to them, they set about translating and commenting on the Scriptures, substituting a different interpretation of the disputed passages, and thus sapping the very foundations of the whole fabric of church authority. A sketch of the manner in which the Reformation began in Germany is given under LUTHER.

It has been maintained by several writers that the principles asserted by Luther and other reformers were those of the early ages of the church: but all that can be proved seems to be that in almost every age since the apostolic times there has been here and there a display of opposition to the absolute system in the church; that some peculiar doctrines of Luther and Calvin had been asserted by others long before them; and that the Valdenses especially and their neighbours of the valleys of Dauphiné had retained from time immemorial a system of church discipline similar to that established by the Reformation in the churches of Switzerland and Scotland. [VALDENSES.]

Principal Epochs in the History of the Reformation.—Luther began his course of opposition to Rome by his memorable theses against the sale of indulgences, which he affixed on the doors of the cathedral of Wittenberg in his disputation with Eckius, questioned the supremacy of the pope over the church, as well as the doctrines of purgatory, auricular confession, and absolution; and he afterwards published several treatises, in which he expressed his dissent more openly.

In June, 1520, pope Leo X. issued a bull condemning as heretical forty-one propositions extracted from Luther's writings. Luther appealed from the pope to the General Council, and publicly burnt Leo's bull (December, 1520). On the 6th of January, 1521, Leo expelled Luther from the communion of the church. In April of the same year Luther appeared before the diet of the empire at Worms, defended the substance of his tenets, and maintained that both popes and councils were liable to err. He was ordered to leave Worms, which he did unmolested, as he had a safe conduct; but after his departure he and his adherents were put under the ban of the empire.

Contemporary with Luther, Zwingli was pursuing a like course in Switzerland. It was in 1518 that Zwingli, without knowing then anything of Luther's proceedings at Wittenberg, opposed the sale of indulgences in the church of Einsiedlen, and preached against the abuses of that practice. In 1519, Zwingli, being transferred to the Gross Münster, or collegiate church of Zürich, began to preach openly not only against indulgences, but against the numerous outward forms of church worship, which, he said, 'fatigued the body without enlightening the mind or purifying the heart.' About the same time Bullinger at Bremgarten, Œcolampadius at Basle, Glareanus at Glarus, Wyttenbach at Bienne, and Berthold Haller at Bern, preached similar principles; they insisted upon the Liturgy being translated into the oral language of the people, and gradually proceeded to question the right assumed by the Roman pontiff of deciding all questions of religion. The court of Rome, whose attention was engrossed by Luther's German schism, did not for some years notice what was going on in Switzerland; but the bishop of Constance forbade the preaching of the new doctrines, and ordered the Papal bulls against Luther to be duly registered and promulgated. It appears that the bishop considered the new opinions in Switzerland as derived from and identical with those preached by Luther in Saxony. This however was not exactly the case, for the Reformation of Switzerland was of native growth, and independent of the German Reformation; and it differed from it from the first in some of its doctrines.

At Zürich, in 1522, Zwingli published his 'Apologeticus Architeles,' in defence of his doctrine. Conferences were held between Zwingli and his friends (who now assumed the name of 'Evangelicals'), and Faber, vicar-general of the bishop of Constance, and other papal advocates, but no approximation was effected between the two parties. In 1523 the great council or legislature of Zürich forbade the preaching of any doctrine which was not clearly founded on the Scriptures, and removed the images from the churches. Shortly after they abolished the service of the mass, as well as processions and pilgrimages, promulgated a new Liturgy, and suppressed convents. In 1526 conferences were held at Baden between the Evangelicals and several Roman Catholic doctors and monks. An account of the proceedings was published at Luzern: 'Caussa Helvetica Orthodoxæ Fidei contra Martinum Lutherum, Zwinglium, Œcolampadium, &c.'

In January, 1528, the Council of Bern appointed a new and final conference to be held in that city, and invited the four bishops of Switzerland, Basle, Lausanne, Constance, and Sion, as well as deputies from the clergy of all the cantons, to attend. The four bishops declined, and six cantons, namely, Luzern, Zug, the three Waldstätten, and Freyburg, did not send any deputations. Zwingli came from Zürich, accompanied by twenty-five deputies: Basle, Schaffhausen, Appenzell, Glarus, Soleure, as well as the Grisons, and the towns of St. Gall, Bienne, and Lausanne, sent each its deputation. It was altogether a solemn assembly, the most important that had ever met in Switzerland on this momentous controversy. Regulations for the maintenance of order and the mode of proceedings were enforced by the magistrates of Bern. It was at the same time proclaimed that 'no argument should be admitted in the conference which was not grounded on a text of Scripture, to the exclusion of other authorities. This exclusion militated strongly against the Roman Catholic disputants; the conference however lasted nineteen days, and the Evangelical zealous Roman Catholic priest of Soleure observed bitterly, that had his brethren, and especially the higher clergy, devoted more time to study and less to their pleasures, the result of the conference would have been different.

The conference being closed, the Council of Bern, considering the result to be in favour of the Evangelicals, published the following theses, which had been discussed; and they approved and confirmed them. 1. The holy Christian Church, of which Christ is the only head, is born of the word of God, and continues to adhere to it, and does not listen to the voice of the stranger 2. The Church of Christ makes no laws and ordinances which are not grounded upon the word of God; therefore all the ordinances of men which are called by the name of commandments of the church are not obligatory unless it be proved that they are founded on the word of God. 3. Christ alone is our wisdom, our justice, our redemption, and satisfaction for the sins of the whole world: it follows therefore that to acknowledge other merits as means of salvation and satisfaction for sin is to renounce Jesus Christ. 4. It cannot be proved from holy Scriptures that the body and blood are contained materially and bodily in the eucharistic bread and wine. 5. The mass, such as it is now, in which the sacrifice of Jesus Christ is daily offered to God the Father for the sins of the living and the dead, is contrary to Scripture. 6. Jesus Christ, having alone died for us, must be alone invoked as our mediator and intercessor with God the Father. It is therefore without any foundation on Scripture that we are told to invoke other mediators and intercessors from among the dead. 7. There is no scriptural evidence for asserting that there is after this life any purgatory or place in which souls are purified by fire. Therefore all the services for the dead which have been introduced, as vigils, masses, funeral processions, oblations, anniversaries, lamps, wax tapers, and other such things, are useless and vain. 8. To make and set up images, in order to bestow upon them a religious honour or worship, is contrary to the word of God both in the Old and the New Testaments; they ought therefore to be abolished whenever there is danger that the people should bestow upon them a religious honour. 9. Marriage is not forbidden by Scripture to any class or order of men; it is, on the contrary, recommended to all, in order to avoid fornication and lewdness. 10. A public fornicator is excommunicated by the Scriptures; and there is no order of men in whom lewdness is more pernicious than it is in clergymen, on account of the influence of their bad example and of the disorders consequent upon it.

These ten propositions embody the substance of the Reformation, not only in Switzerland but in the rest of Europe; for with the exception of the fourth, concerning the eucharist, which differs from the Lutheran doctrine in the Augsburg Confession on that particular point, all the principles contained in them are acknowledged by all the reformed churches, however those churches may differ among themselves on some other abstruse points, such as predestination and grace, or on subjects of church discipline. The doctrines expounded in these ten propositions constitute their common ground of union in opposition to the doctrine and practice of the Roman Church, and they also exhibit at one view the fundamental points on which the Reformed Churches dissent from Rome; for the question of the supremacy and infallibility of the pope is evidently contained or implied in the second proposition. Those points of dissent are neither few nor unimportant, and are expressed perhaps more clearly, soberly, and concisely in the above Swiss declaration than in any of the more elaborate confessions of faith subsequently promulgated by the various Reformed Churches.

Conjointly with the publication of the above ten propositions, the great and little councils of Bern published, on the 7th of February, 1528, an edict of Reformation based upon them, consisting of thirteen articles, declaring, among other things, that the spiritual jurisdiction of the bishops of Constance, Basle, Lausanne, and Sion over the subjects of the state was abrogated; that the deans and other members of chapters should take an oath of allegiance to the little council or executive of Bern; that all rectors, curates, and other presbyters were not to teach or preach anything contrary to the ten theses already approved, under pain of being deprived of their benefices; that monks and nuns might remain in their convents if they liked, but without receiving any novices or boarders; that those who wished to leave their convents were at liberty to do so, and to take away what they brought with them at the time of admission It also declared that the mass and images were finally abolished at Bern, but that as there were in the country districts various populations which were yet uninstructed, the council did not wish to act harshly towards them, but, praying to God that they might become enlightened, left them the power of abolishing or retaining the mass or images, according to the vote of the majority. In the meantime, it enjoined both parties not to insult or revile each other.

Although the ceremonies of the mass, the offices for the dead, &c. were abolished, yet the endowments and gifts for those objects, quit rents, fees, tithes, and other dues continued to be paid as formerly, 'in order,' said the edict, 'that those clergymen of the old communion who had benefices might enjoy their income during their lifetime, and live and die in peace.' After their death, the council of Bern reserved to itself the disposal of the property according to justice and for the benefit of the state. Those persons however who had given property to convents or had founded chaplainships and other minor benefices without cure of souls might resume their gifts if they chose. Those cures or benefices which were annexed to convents were to be disposed of by the council, but no lord, patron, or collator of any church was to appropriate to himself or dispose of any part of its revenues. The precious vases and other utensils and ornaments of the churches were to remain in their places for the present; but permission was given to those companies, corporations, and families that owned altars and chapels, to claim the ornaments and utensils attached to them. The clergy as well as nuns were allowed to marry. Every person was allowed to eat of all sorts of meat without distinction of days, but excess and drunkenness were forbidden. Taverns and other public places were to be shut up at nine o'clock in the evening. All clergymen having the care of souls were to preach four times a week, Sunday, Monday, Wednesday, and Friday, except during the seasons of sowing, reaping, and vintage, the peasants being then unable to attend church on week-days. (Ruchat, *Histoire de la Réformation en Suisse.*)

These regulations of the government of Bern, which were similar to those adopted by Zürich, being conceived in a spirit of mildness, charity, and liberality, reflect great credit on the spirit that governed the Swiss Reformation, of which Bern and Zürich were the main pillars, and contrast advantageously with the harsh and rash fanaticism of many reformers in other countries. Even Roman Catholic states in our own times, when engaged in suppressing the monastic orders in their territories, might have learned from the equitable and humane conduct of the dissident government of Bern towards the convents of that state, a lesson of honourable forbearance, which however they have been far from following.

There are many persons at present in Protestant countries, and especially in England, who from reading the history of England, and more particularly the period of Henry VIII., have conceived a kind of prejudice against the English reformation, which they are apt to identify with the capricious and cruel acts of that tyrannical prince. Led by his own violent passions and intent on his selfish gratification, Henry VIII. effected a schism with Rome on matters of jurisdiction by asserting his own supremacy, but not on doctrinal points, in which he continued to adhere to the tenets of the Roman church. He did not produce or encourage the Reformation; on the contrary, he persecuted and put to death the real reformers. He seized the property of convents, but bestowed it chiefly upon laymen, his own courtiers. The Reformation in England sprung from among the people and the clergy. It had begun with Wicliff; it spread from England to Germany among the Lollards and the Hussites, and was carried back from the Continent to the shores of Britain with a fresh impulse from the preaching of Luther, Bucer, and the Swiss reformers. The schism of Henry VIII. paved the way, but it did not originate nor promote nor establish the doctrines of the Reformation; they made their way rather in spite of, than by the favour of that capricious king. It was only under his successor, Edward VI., that the Reformation found favour with the throne, and became established by authority. Still the origin of the church of England as a body independent of Rome dates from the wayward deeds of Henry VIII., and when that church afterwards adopted the reformed doctrines, there was a great admixture of political and state reasons in the final establishment of it, especially under Elizabeth, and consequently much severity and harshness were exhibited towards those who adhered to the old religion, which threw for a time a dubious light over the ascendency of the Reformation in England. But the case was very different with the Reformation in Germany and Switzerland. Those countries were the native soil and the battle-field of the Reformation: there the first reformers took up their ground at once on doctrinal points against Papal Rome; they were obscure individuals assailing the stupendous fabric of ages, and when they afterwards gained the favour of some princes of the empire, they had still against them the fearful odds of the Imperial authority backed by all the influence of the House of Austria and of a powerful hierarchy, and by the numerical majority of the population of Germany.

While Zwingli and his friends were propagating religious reform in Switzerland, Luther was proceeding in his career in Germany. In 1521-2 he wrote against auricular confession, clerical celibacy, monastic vows, and prayers for the dead. In 1523 he preached against the mass, which was about that time abolished by the Austin friars in their church of Wittenberg. A number of monks quitted their convents and married. Frederic, called 'the Wise,' elector of Saxony, without openly countenancing the schism, tolerated these proceedings. Pope Adrian VI. sent a Nuncio to the Diet at Nürnberg to rouse the States against the Lutherans, acknowledging at the same time that many abuses had crept among the clergy, which should be reformed. But the majority of the Diet besought the pope to convoke a general council, and drew up a list of no less than a hundred grievances, which are known by the name of 'Gravamina Centum.' The Diet separated, postponing the consideration of the new doctrines to the next session. In 1524 Luther divested himself of his monastic dress, and in the following year he married. Frederic, elector of Saxony, died in 1525. John, who succeeded him, openly embraced the Reformation and commissioned Luther to prepare a new church service for his dominions. Luther also published his two catechisms for the use of schools, as well as his German version of the New Testament. His friend Melanchthon co-operated zealously in establishing the Reformation in Saxony. Martin Bucer was pursuing a similar course at Strasburg. [Bucer; Melanchthon.] Between the years 1525 and 1529 Luther's doctrines spread rapidly through Germany. The elector palatine, the landgrave of Hesse, the duke of Deux Ponts, the margrave of Brandenburg and grand-master of Prussia, and numerous cities, adopted the Reformation. The descendants of the Hussites of Bohemia inclined to the same course. The doctrines of Luther spread also to Sweden, where the canon Olaus Petri, archdeacon Anderson, and others of the clergy adopted them; and at last king Gustavus Vasa, having assembled a synod at Orebro, the Reformation was solemnly proclaimed in 1528. It ought to be observed that the rapid diffusion of the Reformation through Germany, though proceeding in a great measure from the popular feeling, was also greatly favoured by the self-interest of the various princes, who eagerly seized upon the wealth of the suppressed convents, collegiate churches, and other ecclesiastical establishments—a selfish motive which no one deplored or censured more bitterly than Luther himself. In the case of Sweden the ascendency of the doctrines of the Reformation was promoted by the feeling of national independence against the Danes, who were favoured in their designs by the intrigues of the Catholic clergy. [Gustavus Erickson.] In the history of the Reformation, as in that of other great human contests, we perceive an admixture of various causes and influences, of good and evil, of conviction and self-interest, of spirituality and sensualism.

In March, 1529, at the diet of the empire, assembled at Speyer, the Roman Catholic princes proposed that those who should continue to embrace or favour the new doctrines should be placed under the ban of the empire; but the opposition raised by the elector of Saxony, the landgrave of Hesse, the margrave of Brandenburg, and the deputies from the imperial cities, caused the motion to be rejected. The next object of the Roman Catholics was to divide the Lutherans from the followers of Zwingli, or Sacramentarians, as they were called, who denied the real presence, and whose doctrines had spread to Strasburg, Constance, Lindau, Memmingen, and other towns of Germany; for if the Lutherans could be made to join in the proscription of the Zwinglians, they might afterwards be assailed in their turn. Accordingly a decree was drawn up proscribing the Anabaptists, a fanatical sect which had committed great disorders in the Netherlands and other parts, and which may be considered as a wild offshoot of the Reformation. The decree also condemned the denial of the real presence in the eucharist, and prescribed that the mass should be preserved, and that ecclesiastics both Lutheran and Roman Catholic should not annoy each other for their respective belief, until a council or another Imperial Diet should finally decide upon the matters in dispute, and that the gospel should continue to be preached according to the sense of the most approved doctors of the church. The Lutheran princes and deputies however, perceiving the policy of the Roman Catholics, refused to sanction the decree, especally as it was so expressed as to condemn indirectly some of their own tenets. The Roman Catholic princes, who formed the majority, insisted on the decree, and it was then that the reformed princes and deputies, making common cause without distinction of Lutherans or Sacramentarians, delivered in a formal 'protest,' dated from the Diet of Speyer, April 19, 1529, from whence the denomination of 'Protestants' has been derived. In that celebrated document they maintained that the decree of the preceding Diet, which connived at toleration until the meeting of the General Council, having passed unanimously, could only be abrogated by unanimous consent; that they could not accede to the sweeping condemnation of the Anabaptists and Sacramentarians without their being summoned and heard in their defence; that as the Romish mass was contrary to Scripture, they could not attend it themselves nor let their subjects attend its celebration; that the clause which stipulated that the gospel should be preached only according to the interpretation of the church, did not remove the main difficulty, as the question was, which of the churches was the true one. This protest was signed by John, elector of Saxony; George, margrave of Brandenburg and grand-master of Prussia; Ernest and Francis, dukes of Luxemburg; Philip, landgrave of Hesse; Wolfgang, prince of Anhalt; and by the deputies of fourteen cities, Strasburg, Nürnberg, Ulm, Constance, Reuttingen, Hildesheim, Melingen, Lindau, Kempten, Heilbrunn, Weissenburg, Isny, Nordlingen, and St. Gall. (Spalatinus, *Annales Reformationis;* and also *Vitæ aliquot Electorum Saxoniæ.*)

The landgrave of Hesse, feeling the necessity of unanimity among the reformers for their common preservation, endeavoured to effect an approximation between the Lutherans and the Zwinglians. After some hesitation on the part of Luther, a conference was agreed on at Marburg between Luther and Melanchthon on one side, and Zwingli and Œcolampadius on the other. Melanchthon has given an account of this conference. Zwingli and his friends were disposed to make concessions to Luther in regard to the questions of original sin, justification by faith, and absolution, on which they differed; but when they came to the eucharist, they could not agree. Luther adhered to the literal sense of the words 'This is my body,' which however he explained, by saying that the real body co-existed with the elements of the bread; and this he called consubstantiation, which was different from the Roman Catholic transubstantiation. Zwingli maintained that the words had a figurative meaning, and that the bread was only the type of Christ's body. Upon this Luther grew warm, and expressed his astonishment at Zwingli's presumption in opposing the interpretation of all the doctors and commentators from the earliest ages of the church. He seems however to have been ignorant of the controversy that had already been raised on the subject in the ninth century by Paschasius Radbert, a Benedictine monk and abbot of Corbie, who published a treatise 'Concerning the Sacrament of the Body and Blood of Christ,' which he presented to Charles the Bald, and in which he positively maintained that which had not been previously decided by any council or general authority, namely, that after the consecration of the bread and wine, nothing remains of those elements except the outward figure, under which the body and blood of Christ, such as when he suffered upon the cross, were really and locally present. Charles commissioned two of the ablest writers of his time, Ratramn, or Bertram, a monk of Corbie, and Joannes Scotus Erigena, to investigate the assertion of Radbert. The work of Scotus is lost, but it appears that he was opposed to the real presence. Ratramn's opinion was qualified: he asserted the real presence, but he denied the identity of the body with that which suffered on the cross, and especially the consequence deduced by Radbert, that Jesus Christ was sacrificed anew every day at the consecration. The treatise of Ratramn is still extant. Hincmar and other theologians engaged in the dispute, some for and others against Radbert; and the question was revived in the eleventh century by Berenger, who denied the bodily presence, professing to follow the opinion not only of Scotus, but of Augustin, Jerome, and Ambrose; until Gregory VII. obliged him to retract before a council, and to subscribe to the identical propositions maintained by Radbert. [BERENGER; CONSUBSTANTIATION.]

Luther and Zwingli separated without coming to an understanding, Zwingli observing that both parties were agreed in the fundamental principles of Christianity, and that in others they might have charity for each other, and might be united under the common denomination of reformers and brethren. Luther offered to part in Christian charity, but not in brotherhood: they shook hands in presence of the landgrave, and agreed to refrain from open controversy.

In the following year, 1530, Charles V. convoked a diet of the empire at Augsburg for the month of April, and directed the Evangelical members of the same to bring with them a written profession of their faith in German and Latin. The most eminent theologians, both Roman Catholic and Reformed, were summoned. Luther alone, in consequence of the former decree of the diet of Worms of 1521, was forbidden to appear in person; but the elector of Saxony directed him to remain at Coburg, in order to be consulted in case of need. The Reformed divines of the various states set about writing a summary of their doctrine; and the task of examining all these papers, and of extracting from them 'a good and explicit confession of faith,' which should be acceptable to all German reformers, was entrusted to Melanchthon. When the Confession was written, John, elector of Saxony, sent it to Luther at Coburg to be revised. Luther approved of it without any exceptions. On the 25th June, 1530, the elector, accompanied by his son John Frederic; by George, margrave of Brandenburg; by Ernest and his brother Francis, dukes of Brunswick and Lüneburg; Philip, landgrave of Hesse; Wolfgang, prince of Anhalt; and the deputies of the town of Nürnberg and some other free cities, came into the Diet, and presented that important document to the emperor, who directed the chancellor to read it aloud to the assembly. Melanchthon had softened some of the points of dispute, in order to conciliate, if possible, the good will of the Roman Catholic party. The Confession of Augsburg was published in 1531, 'Confessio Augustana,' and consisted of twenty-eight articles. The real presence in the sacrament without transubstantiation, justification by faith alone, the number of sacraments, communion of both kinds, and the invocation of the saints, were the chief points comprehended in it. The Roman Catholic theologians undertook to refute the positions of the reformers, who replied by an 'Apology for the Confession,' which was likewise written by Melanchthon. Seeing that there was no hope of an agreement, Charles V. and the Roman Catholic princes issued an edict in November, 1530, which, without denying the abuses and corruption which had crept into the church, promised that the emperor would insist on the pope calling a general council for their correction, and in the mean time enjoined all parties to conform to the regulations of the Roman church, and not to write or preach against any article of the antient faith, or to admit any novelties in doctrine or discipline: it further exhorted them to unite in suppressing the heresies of the Anabaptists and Sacramentarians. The latter had also presented their confession of faith to the Diet on the part of the four cities, Strasburg, Memmingen, Lindau, and Constance; which is generally known by the name of the Confession of Strasburg, or 'Confessio Tetrapolitana.' The German Protestant princes, alarmed by the edict of the emperor, assembled at Smalkald, in December, 1530, with the elector of Saxony at their head, and entered into a league, both religious and political, with the determination of defending their rights and the liberty of conscience, by force if necessary, against all attacks. Thus in the year 1530 the Reformation was finally established in Germany, first by the Confession of Augsburg, which was published as the acknowledged and common creed of a great body of Christians; and secondly by the league of Smalkald, which made that creed the bond of union of a powerful political confederacy.

The landgrave of Hesse invited the Reformed cantons of Switzerland to join the league of Smalkald; but as they refused to sign the Confession of Augsburg, the elector of Saxony declined to admit them into the Protestant league, and thus the Swiss Evangelicals continued distinct from the Lutherans, though they joined in a separate league with the city of Strasburg, and the landgrave of Hesse, who adopted their doctrines. In a great synod held at Bern in 1532 (Zwingli had died the year before), the Helvetic confession of faith was finally proclaimed; being mainly based upon the ten theses or propositions agreed upon at Bern in 1528, and which have been given above. In 1566 a new edition of the Helvetic Confession, signed by all the Reformed states of the Swiss Confederation, was published at Zürich: 'Confessio et Expositio simplex orthodoxæ fidei et dogm[illegible]um Catholicorum sinceræ religionis Christianæ, concordita ab ecclesiæ Christi Ministris qui sunt in Helvetia, Tiguri, Bernæ, Glaronæ, Basiliæ, Scaphusii, Abbatiscellæ, Sangalli, Curia Rhætorum, et apud Confederatos Mylhusii, item ac Biennæ; quibus adjunxerunt se Genevensis et Neocomensis ecclesiæ ministri, una cum aliis evangelii Præconibus, in Polonia, Hungaria, et Scotia,' 8vo. Tiguri, 1566, republished in 1651. A French translation was lately published at Lausanne, 'La Confession de Foi Helvetique,' 1834. It is the same as that of the French Protestants, as they are commonly though improperly called: 'La Confession de Foi des Eglises Reformées de France,' Montpellier, 1825. The Helvetic Confession consists of thirty chapters, an abstract of which is given in the 'History of Switzerland,' published by the Society for the Diffusion of Useful Knowledge, Appendix iv. The same work contains a full account of the rise, progress, and final settlement of the Reformation in Switzerland. The Reformed doctrines had early spread to Geneva, through Bonnivard, and afterwards through Farel, a native of Dauphiné, who had come to Geneva about the year 1530. After several years of noisy and turbulent controversy, attended by violence and even bloodshed, the great council forbade the mass, images, &c. in 1534. It was only in 1536 that John Caulvin or Calvin made his appearance at Geneva on his return from Italy, from whence he had escaped through fear of the Inquisition. Farel induced him to settle at Genoa as professor of theology. Both he and Farel went further than the Swiss reformers. They abolished all festivals except Sunday, discarded all church ceremonies, used leavened bread for the sacrament, and maintained the doctrine of predestination in all its sternness. This drew upon them the disapprobation of the Evangelical synod, then assembled at Lausanne for the purpose of regulating the discipline of the Helvetic Church. As Calvin and Farel however would not submit to the decision of the synod, the council of Geneva ordered them to leave the town in 1538. Farel settled at Neuchatel, where he remained till his death. Calvin went to Strasburg, where he established a French Evangelical church; but in 1541 he was invited to return to Geneva, where he became the civil as well as religious leader of the republic. The rest of the career of this remarkable man is given in the article CALVIN. His peculiar tenets concerning religious doctrine and church government, as expounded by him in his 'Institutiones,' are noticed in the article CALVINISM. Calvinism became the creed not only of Geneva but of the French Huguenots, as they were styled, a word said to be derived from Eidgenossen, or Confederates, which was the name assumed by the popular party at Geneva which brought about the Reformation. Calvinism spread also into the Netherlands and parts of Germany, and afterwards into Poland, Hungary, and Transylvania, and it was brought by Knox into Scotland. Calvinism thus became the third great branch or division of the Reformation, Luther and Zwingli being the heads of the other two. The doctrines of predestination and grace are its distinguishing dogmas. The distinction however between the Zwinglians and the Calvinists is not material, and they are now considered as one, having the same confession of faith.

In France, as early as 1530, the doctrines of the Reformation had found their way from Germany and Switzerland. Some of those doctrines had lingered in the south for ages before, especially in the mountains of Dauphiné bordering on the Valdenses. Pierre Robert d'Olivet, Michel Cop, rector of the University of Paris, Beza, and others, adopted and spread them; and Margaret, sister of Francis I., and Renée, daughter of Louis XII., gave them their countenance. But Francis I., who through policy secretly encouraged the Protestant states of Germany against the emperor, persecuted his own subjects who had embraced the new doctrines. The stake and the faggot were employed at the same time in France and in England, by Francis and Henry VIII. against the reformers. In 1535, Francis, attended by his family, the clergy, the magistrates, and other officers of state, was present at the burning by a slow fire of six citizens of Paris, who had been condemned by the parliament as heretics. The execution lasted two hours. This was the forerunner of many scenes of a similar character which disgraced France for more than half a century. In 1545 the villages of Merindol and Cabrieres in Provence were burnt, and the inhabitants of both sexes were massacred on account of heresy, in consequence of an order of the parliament of Provence and of Francis I. The persecutions, the civil and religious wars, the truces and other vicissitudes of the French Calvinists, during the reigns of Francis I., Henri II., Francis II., Charles IX., and Henri III., are part of the history of France. [Barthelemy, St.] De Thou, in his 'Historiæ sui Temporis,' Beza, 'History of the Reformed Churches of France,' and the recently published 'Mémoires et Correspondence de Duplessis Mornay pour servir à l'Histoire de la Reformation et des Guerres civiles et religieuses en France depuis l'an 1571 jusqu' en 1623,' Paris, 1824-34, are the best contemporary authorities for that period. At last Henri VI., by his 'Edit de Nantes,' 1598, acknowledged the Reformed communion as the lawful creed of a part of the French population.

In Germany, during the same period, the course of Protestantism did not run smooth, although there were no stakes lighted nor massacres perpetrated. The Protestant states were too powerful, and Charles V. had too much need of their support against the Turks and his other enemies, to quarrel with them on the score of religion, and push the dispute to extremities. By the treaty of Nürnberg, 1532, the obnoxious decree of Augsburg, of 1530, was revoked so far that the Lutherans were to retain their present power and privileges, but were not to make any further innovations in faith or discipline than were contained in the Confession of Augsburg, nor send missionaries into Roman Catholic states, nor encourage the subjects of Roman Catholic princes to take refuge in their territories, nor to support the Anabaptists or Zwinglians; and that all proceedings in the Imperial chamber on the score of religion should cease.

This pacification of Nürnberg, as it is called, lasted till 1546, the year of Luther's death. That great reformer was busy during this period in consolidating his church by his teaching and writing, and by his influence over the Protestant princes, who consulted him in all matters of religious polity, and in completing his great work, the German translation of the Bible. He also effected, in concert with Bucer, a union with the Sacramentarians of Germany, who came to a compromise on the subject of consubstantiation.

The Swiss however, or Zwinglians, refused to sign the articles on which Luther and Bucer had agreed, and they continued separate. Still the union of all Protestant Germany under one banner was a great step, and the accession to the Protestant party of Maurice, duke of Saxony, the elector palatine, and Ulrick, duke of Würtemberg, greatly added to its strength. Their power was shown in the war which followed against the emperor; for although in the first instance (in 1546), through the defection of Maurice of Saxony, whom Charles had won over, the Protestant league was defeated, it afterwards recovered itself. The league took the field again with Maurice at its head in 1552, and obliged Charles to sign the treaty of Passau in August of that year, by which it was agreed that the Protestants should retain their liberties and possessions, until the meeting of a diet, which should establish a perpetual religious peace, and that during the interval there should be no more disputes about religion. In 1555 the promised diet assembled at Augsburg, and framed the articles of a religious peace for Germany, which, after some modifications, were subscribed by both parties. The terms were: that neither emperor nor Roman Catholic prince should attempt to force back Protestants into the bosom of the Roman Catholic church, nor Protestants force Roman Catholics to renounce their faith; that every prince should have the power of establishing, in his own state, which of the two communions he thought proper, and of granting toleration to the other if he pleased; that those subjects who professed a creed different from that established in their state, might retire unmolested with their property, and settle in another state where their faith was professed; that no Roman Catholic bishop should have jurisdiction over those who follow the Confession of Augsburg; that Protestant clergymen should retain possession of their benefices, and Protestant princes the right of administering the property of the church of which they were actually possessed; that if a Roman Catholic ecclesiastic abandoned his faith, he should lose his dignity, and his benefice should be conferred upon another, but that his reputation or civil rights should remain untouched; that the Imperial chamber should do justice to both parties, and the members of it without exception might be Protestant as well as Roman Catholic.

Such were the conditions of the peace of Augsburg, by which the Protestant religion was acknowledged in the German empire, and when we reflect that these conditions were agreed upon about three centuries ago, by Protestants and Roman Catholics, by clergy and laity of both communions, by bishops and princes of the empire, we cannot help being struck with the equity and reasonableness of those who framed it, as honourable alike to German feeling and German judgment. This peace was broken many years after by the war which is known by the name of the Thirty Years' war (1619-48), but the treaty of Westphalia, which terminated the war, confirmed the articles of the religious peace of Passau and Augsburg, and extended its benefits to the Calvinists as well as the Lutherans. The princes, states, and towns of the empire of the three communions were placed on a footing of equality by this treaty. In all matters of religion, and in other disputes between Roman Catholics and Protestants or Calvinists, the diet was to decide not by a majority of suffrages, but by amicable accommodation. In extraordinary commissions appointed by the diet, the commissioners were to be all Protestants, if the matter concerned Protestants only; all Roman Catholics, if it concerned Roman Catholics only; and an equal number of each, if it concerned both religions. Toleration and the exercise of private worship for every individual were also secured.

The consequence of this tolerant arrangement has been that since the peace of Westphalia religious persecution has been unknown in Germany, and German Roman Catholics, accustomed to live in peace and intercourse with their Protestant neighbours and fellow-subjects, exhibit none of that fanatical horror which the ignorant population of Spain and of many parts of Italy still evince at the very name of a heretic.

The doctrines of the Reformation had made many converts in the Netherlands in Luther's lifetime, and a fresh influx of Calvinists from France and Switzerland increased the number of dissidents from the Roman church. The wild outbreak of the Anabaptists at Leyden, Münster, and other places threw discredit for a time on the cause of the Reformation, but these disturbances were soon put down. During the reign of Charles V., the friends of the new doctrines in the Netherlands were persecuted as heretics, and many suffered death by sentence of the regular courts of the country; but after Charles abdicated, at Brussels in 1555, in favour of his son Philip, the latter, in order to extirpate heresy more effectually, sent inquisitors from Spain to establish the tribunal of the Holy Office in the Netherlands. This gave rise to a strong opposition both from the nobles and the people, which, being mixed up with political grievances, led to an open insurrection against Philip. During the long war which followed between the rebels and the Spanish forces, some of the provinces separated from the rest, and the seven northern provinces of Holland, Zealand, Guelderland, Friesland, Utrecht, Overyssel, and Groningen formed a confederacy by the name of the 'Seven United Provinces,' and proclaimed liberty of conscience. The great majority however of the population of the seven provinces followed the doctrines of Calvinism, and have remained attached to them ever since. The confession of faith for the provinces of the Netherlands was published in 1562, and was afterwards approved by the members of the synod of Emden in 1571. The disputes that broke out afterwards between the Arminians and Gomarists are related in the article Arminius. The synod of Dort, in 1618, revised and republished the Netherlandish Confession.

About the year 1556 the Lutheran or Protestant creed was adopted as the state religion in the kingdoms of Denmark and Norway, under king Christian III. Denmark however, as well as Sweden, has retained episcopacy.

The Protestants or Lutherans, as well as the Calvinists, became very numerous in Poland under the reign of Sigismund

Augustus, and many of the high nobility had embraced the Reformed doctrines. An approximation was effected between the Lutherans and Calvinists, and a confession was drawn up, in concert, by the clergy of both communions, at Sandomir, in 1570, called 'Consensus Sandomiriensis.' The followers of the Reformation however never constituted the majority in Poland, and being afterwards persecuted under Sigismund III. and some of his successors, their number was greatly reduced, but they were never annihilated, and Lutheran and Calvinist congregations have continued to exist in most towns of Poland. The most complete account of the Reformation in Poland is in the recent work of Count Krasinski (*Historical Sketch of the Rise, Progress, and Decline of the Reformation in Poland*, London, 1838).

In Hungary and Transylvania both Lutherans and Calvinists have long been established, and they constitute at present about one-fourth of the population of those countries, enjoying equal rights with the members of the Roman Catholic and Greek churches.

The doctrines of the Reformation spread into Italy from Switzerland and Germany at an early period, and found proselytes in several towns, especially Ferrara, where Renée of France, duchess of Este, countenanced them; at Lucca, Faenza, Milan, and Naples. Several learned monks and priests, the Capuchin Ochino of Siena, Vermigli, a canon of Florence, Montalcino, a Franciscan friar, Lorenzo Romano, an Augustine monk, and others, adopted and preached the new tenets. Meetings and private places of worship were established in various towns. Paul III., alarmed at this change, established, in 1543, the Congregation of the Holy Office at Rome, with full powers to proceed against heretics independent of the ordinaries, and he also sent inquisitorial commissioners into the various provinces of Italy for the same purpose. [OFFICE, HOLY.] By these means he effectually checked the course of the Reformation, and his successors Paul IV. and Pius V. completed its extirpation by the most severe measures. Many of the followers of the Reformed doctrines suffered death either by fire or by the sword of the executioner. [PIUS V.] Numerous families emigrated to Switzerland on account of religion, especially from Tuscany and Lombardy. A considerable district of Calabria, near Cosenza, which is said to have been originally peopled by a colony from the valleys of Piedmont, having publicly adopted the tenets of the Reformation, and sent for some Calvinist preachers from Geneva to teach them and their neighbours, the duke of Alcala, Spanish viceroy of Naples, about 1560, sent several inquisitors with a body of armed men, who arrested and put to death many people in the village of San Sisto. Upon this the neighbouring villages broke out into open revolt. The town of La Guardia Lombarda sustained a regular siege. Being taken at last, a general massacre of the inhabitants took place, with circumstances of the greatest atrocity. (Botta, *Storia d'Italia*, b. x.)

At Locarno, an Italian district on the Lago Maggiore, subject to the Swiss Catholic cantons, the Reformation had made numerous proselytes, but in 1555 an order came from the ruling cantons for banishing all the Evangelical families from Locarno. The heads of those families being assembled in the town-hall, the sentence was read to them, and they were preparing to obey it, when a priest entered the hall, and suggested that the wives and children of the heretics should be detained in order that they might be converted. But the Swiss Roman Catholic deputies shuddered at the proposition: 'We will not alter the sentence which has been pronounced,' they replied; and the exiles, accompanied by their wives and children, set off across the Alps, and took refuge chiefly at Zürich, where the families of Orelli, Muralti, and others still retain their name and traditions.

In the district of Valtellina, which was subject to the Grisons, the Reformed doctrines were openly professed by many, and encouraged by their rulers. But the two parties, Roman Catholics and Protestants, having become identified with the political parties in the Grisons, one of which was favourable to an alliance with Austria and Spain, and the other opposed to it, feeling ran high, acts of violence were committed, and the Roman Catholics, being the more numerous in Valtellina, conspired against the Grison government, and in July, 1620, massacred all the Protestants in the valley, their own countrymen as well as Grisons, to the number of several hundreds. The Reformed religion was thus extirpated in the Valtellina also, and all Italy has ever since remained exclusively Roman Catholic, with the exception of the valleys of Pignerol, the inhabitants of which, after many persecutions, have been allowed to retain and profess their antient faith.

In Spain the doctrines of Luther and Calvin spread in the sixteenth century, and made numerous proselytes at Seville and other places; but the arm of the Inquisition effectually eradicated them. M'Crie has written the history of the rise, progress, and extinction of the Reformation both in Spain and in Italy.

For the progress and final settlement of the Reformation in England, we must refer to the history of this country, and the articles BUCER, CRANMER, CROMWELL (THOMAS), EDWARD VI., ELIZABETH of England, GARDINER, HENRY VIII., MARY I. of England, and POLE, REGINALD. For the Reformation of Scotland, see KNOX and MARY STUART.

Independently of the religious question of the truth or falsehood of the doctrinal points on which the Reformed churches dissent from that of Rome, a question upon which it is not our business here to express an opinion, it is unquestionable that the Reformation, as an historical fact, has exercised a most powerful influence upon the moral, political, and intellectual condition of mankind. The invention of printing, the discovery of America, and the Reformation are three events which, following each other in succession, may be said to have effected a complete change in the face of the civilised world. A writer who is by no means partial to Luther and the other reformers individually, thus speaks of the effects of the Reformation:—'Let the Roman Catholics argue as they please about the unity and universality of their religion, the records of the middle ages prove that, in the majority of men, it was a lifeless tissue of ceremonies, which, from their frequency, could not even strike the imagination; which made assuredly little impression on the heart, none whatever on the understanding. Since Luther's time, religion has been an object of the understanding rather than of the eye; of the heart rather than of the memory. The repetition of a prescribed number of prayers, almsgiving, a journey to some shrine, the veneration of a relic, might in former times satisfy for sin; but from the sixteenth century downwards, it has been admitted that, without true compunction, without reformation of life, such things are ineffectual and even puerile. In this respect the Roman Catholics have gained as much as the Protestants; they have learned spirituality; they have forsaken their cold, unmeaning, and useless observances, for a principle—that of divine love—which pervades the heart; for knowledge, which informs the understanding. In the second place, there has been no less improvement in the conduct than in the feelings and reasonings of men. The tenets of the Reformation produced vices enough, but they were vices less odious than those which previously disgraced society. As religion was in danger of being smothered under an accumulated heap of human observances and opinions, so were morals of perishing through the boundless licentiousness of the period. In this respect too the present Roman Catholic has need to bless the memory of Luther and his colleagues in the Reformation. Cast our eyes wherever we may, we find an amazing improvement in the general state of morals. . . . . In the third place, the Reformation has been exceedingly favourable to civil liberty. The same principle of curiosity which taught men to examine the grounds of their faith, urged them, in an equal degree, to weigh the nature and design of civil government. It was soon discovered that despotism was founded on ignorance; that it had no divine right to support it; that, on the contrary, it was repugnant alike to reason and the word of God. If that word inculcated obedience to the highest powers, it also taught that the poorest and lowest subjects had rights inalienable and sacred; that in the eye of heaven the highest and lowest are equal, all Christian brethren coheirs of another and a better kingdom, equally on earth the objects of the Divine solicitude. . . . . In the fourth place, and as a necessary consequence of this augmented knowledge alike of religious and political rights, was the increased stimulus given to individual exertion. Despotism, whether civil or ecclesiastical, is a sad enemy to social enterprise, to individual activity. When man perceives that he has rights which cannot be invaded with impunity, that the profits of his industry are secured to him by recognised law and custom, he will require no spur to labour; and in proportion as he enriches himself, so will the state be benefited. . . . . Fifthly, the same moral revolution has led to an amazing increase of knowledge. To understand the Scriptures, which Catholics and Protestants admitted to be the common fountain of faith, the early reformers assiduously studied the original tongues, the Hebrew and the Greek, and the attainment served as a key to other departments of knowledge—to history, laws, geography, and antiquities no less than to theology. Prior to the sixteenth century, these languages were almost entirely neglected; they were even condemned by doctors of the church and by universities. The doctors of Louvain and even of Paris stigmatised the study of the Scriptures in the original tongues—in any other than the Vulgate—as the inevitable path to heresy. But this pitiful hostility soon gave way; the Catholics, no less than the Protestants, applied with success to the study of the Hebrew and Greek Scriptures; manuscripts were discovered and carefully collated, and the Divine text was restored to something like purity. . . . . From these and other considerations, it is evident that on the whole the Reformation has been an incalculable good to Europe; it has purified religion and morals; it has improved the intellect, and has guaranteed civil liberty.' (Dunham, *History of the Germanic Empire*, b. iii., ch. 2.)

Among those authors who have written or commented upon the history of the Reformation, the following deserve notice, besides those mentioned in the course of this article: among the Protestants—Beausobre, *Histoire de la Reformation*; Burnet, *History of the Reformation*; Seckendorf, *Commentarius Historico-Apologeticus de Lutheranismo*; Loscherus, *Acta et Documenta Reformationis*; and among the Catholics—Maimbourg, *Histoire du Lutheranisme*; Pallavicini, *Historia Concilii Tridentini*; Bossuet, *Histoire des Variations des Eglises Protestantes*; besides the general historians of the church. The following work, published at Paris about 1823, deserves special mention: *Musée des Protestans célèbres, ou Portraits et Notices Biographiques et Littéraires des Personnages les plus éminens dans l'Histoire de la Reformation, rédigé par une Société de Gens de Lettres, et publié par* G. T. Doin.

REFORMATION, HOUSES OF. [Punishment; Transportation.]

REFRACTION, REFRANGIBILITY. Refraction is the turning of a ray of light, heat, or other imponderable substance from its direction, when it falls obliquely on the surface of a medium differing in density from that through which it had previously moved. The differently coloured rays of light have different degrees of refrangibility, as evidenced by the common prismatic spectrum; in other words, the refractive indices of different lights vary for a given medium. The fundamental law of refraction and the optical effects of this law are discussed under the heads Light and Optics, and a table of refractive indices is given in the article Optics, Practical. For the different refrangibilities of the rays, the articles Dispersion and Achromatic may be consulted, and for one of the most striking phenomena thence arising see Rainbow. On the subjects of Frauenhofer's lines and of double refraction see Dispersion and Polarization.

The doctrine of refraction, as distinguished from reflection, is called dioptrics, and the caustics formed by the continued intersections of refracted rays emanating from a luminous point, are termed diacaustics; properly speaking, these are surfaces, but by confining the investigation to the plane of refraction, they are generally treated as curves. A diacaustic curve, like a catacaustic, has the property of being rectifiable. They are noticed in the articles above quoted, but they are rather objects of analytical dexterity than of practical use.

So long as the medium into which the refracted ray enters remains of uniform density, the ray will pursue a straight course, but every alteration of density in the medium gives rise to a corresponding deviation in the path of the ray. Now the air is a medium of which the density continually increases as its altitude above the surface of the earth diminishes; its density is also altered in the same stratum by inequality of temperature, and frequently from the aqueous and other vapours which it holds. Hence arise the ordinary terrestrial refraction and the phenomena of Mirage, Fata Morgana, &c., which are treated under their respective heads.

A ray of light proceeding from a star which is not vertical, on entering the atmosphere is bent towards the radius drawn from the earth's centre to its point of incidence, and upon its successive incidences on the lower strata it continues to bend towards the successive radii, thus describing a curvilinear trajectory through the air. The star is visible in the direction of the tangent to this curve, at the point at which it meets the eye of the spectator; hence the apparent altitude of the stars is increased by refraction, and thus the sun, moon, &c. are visible before the real time of rising and after that of setting.

From the causes above assigned for atmospheric refraction, it follows that the nearer the direction of the ray is to the plane of the horizon, the greater is its refraction, and the refraction is nothing when the ray is vertical. This is the cause of the apparently oval forms of the sun and moon in the horizon; for the sun's angular diameter being taken at 32 minutes, its lower limb is elevated through horizontal refraction more than its upper by 4 minutes 54 seconds.

Atmospheric refraction of the solar rays after sunset, combined with subsequent reflection, is the cause of twilight, and also of the light thrown on the moon's surface when eclipsed by the earth.

The amount of refraction of rays proceeding from a celestial body would be proportional to the tangent of its zenith distance, if the atmosphere were homogeneous: not only however is this not the case, but its state is continually altering, as shown by the barometer, thermometer, and hygrometer. An empiric formula, the result of numerous observations made by Bradley, gives a good correction relative to the first two of these instruments, viz.:—

Let $r = 57'' \times$ tang. zenith dist. (z);
$h =$ height of thermometer (Fahrenheit);
$a =$ altitude of barometer in inches;
$R =$ the required refraction; then shall

$$R = 57''.\frac{a}{29{,}6}\cdot\frac{400}{350+h}\cdot\tan(z-3r)\text{ nearly.}$$

Similar formulæ have been the objects of analytical research to Laplace and other modern mathematicians; their results are however not well adapted for insertion in this work.

REFRIGERANTS are remedial agents which directly diminish the force of the circulation, and reduce the heat of the body or a portion of it, without occasioning any diminution of the ordinary sensibility or nervous energy. This definition must not be considered as excluding *cold* from among the number of such agents, because it is capable, when carried to extremes, of rendering the sensibility null, and utterly extinguishing the nervous power; it is only its moderate and therapeutical employment which is here contemplated.

The manner in which refrigerants effect the ends which they accomplish is far from being understood; and a remarkable feature in their character is, that they display their peculiar effects chiefly when the action of the organs is above their natural standard, and more heat than natural is evolved. Till we have a perfect knowledge of the sources and mode of formation of animal heat, we are not likely to possess a correct theory of their mode of operating; and at present, whatever plausibility the mere chemical hypothesis of Dr. Murray exhibits, we cannot consider the evolution of animal heat to be other than a vital process. This function is mainly carried on in the capillaries or extreme vessels, and is much influenced by the amount of supply of nervous energy to these vessels. Hence when a limb is paralysed, it is colder than the opposite sound member; or when a single nerve is injured, the parts supplied by it have a lower temperature than the surrounding ones. Whatever therefore hinders the free communication of the nervous power to a part or to the whole system, will lessen its quantum of animal heat. By applying to the surface of the body any acid the calibre of the capillaries is lessened, and hence the paleness which is observed, owing to less blood entering them. As the blood furnishes the pabulum from which the nerves evolve the heat, the less fuel the vessels contain, the less potent will be the heat resulting. The introduction of any article of the class of refrigerants into the stomach appears to operate by sympathy on the whole vascular system, as may be seen in the case of dilute sulphuric acid checking hæmorrhage. The agents which are usually regarded as refrigerants are weak vegetable acids, or very greatly diluted mineral acids; some saline, neutral, or super salts; and cool air, ice-cold water, and externally evaporating lotions. An indirect refrigerant is found in diminishing the quantity of animal food. [Antiphlogistics; Bathing; Lotions.]

REFRIGERATION OF THE GLOBE. Since the mathematical researches of Fourier regarding the diffusion and conduction of heat in a mass constituted as the earth appears to be in the parts near the surface, have become in some degree known, geologists have been much encouraged in attempting to connect with a gradual change and diminution of the internal temperature of the globe, such as would be consistent with Fourier's theoretical results, the higher order of geological inferences. The phenomena of a general if not universal base of once melted rocks below all the strata, the peculiar (often called metamorphic) condition of the lowest of these as compared with the upper, the absence or rarity of fossils in the lowest strata, the evidence of even general high surface temperatures on the antient land and in the antient sea as contrasted with the modern distribution of climates, are all consequences supposed to be derivable from the assumption of the earth having once been thoroughly very hot, and being now partially cooled by radiation of heat into the cold planetary and stellar spaces around us. But though such a deduction of phenomena from a primal condition of our planet is or appears to be correct enough to justify geologists in employing the hypothesis as a means of discovering truth, they must be careful neither to disregard inquiries into the certainty of the fundamental assumption, nor to neglect a scrupulous examination of its consequences.

On the first point Professor Whewell communicated to the Geological Section of the British Association at Dublin (1835) some observations which are likely to be influential on the second point, and which can neither be condensed nor amended.

'The heat of the interior parts of the earth has always been treated of by those who have established the theory of heat upon mathematical principles. They have hitherto considered it as proved upon such principles, that the increase of temperature of the substance of the earth as we descend proves the reality of an *original heat.* But M. Poisson, in his 'Theorie de la Chaleur,' just published, dissents from this opinion, and is disposed to assign another reason for the higher temperature below the surface. He observes that the cosmical regions in which the solar system moves have a proper temperature of their own; that this temperature may be different in different parts of the universe; and that, if this be so, the earth would be some time in acquiring the temperature of the part of space in which it has arrived. This temperature will be propagated generally from the surface to the interior parts. And hence, if the solar system moves out of a hotter into a colder region of space, the part of the earth below the surface will exhibit traces of that higher temperature which it had before acquired. And this would by no means imply that the increase of temperature goes on all the way to the centre.' (*Reports of the British Association for* 1835, p. 66.)

A speculation, perhaps in reality involving such views as those of M. Poisson, though founded on examinations and inferences among the Helvetic Alps, has been of late brought prominently before the geological world by M. Agassiz. According to this very distinguished naturalist, there is evidence from the peculiar effects left by glaciers in the valleys of Switzerland and on the surface of the Jura Mountains, that the icy mantle which now wraps the High Alps once filled the valleys for miles beyond its present limits, and rendered it a mere glacier movement across an ice-filled hollow, which carried the blocks of Mont Blanc and the Valorsine across the Lake of Geneva to the Jura. Recently Dr. Buckland and Mr. Lyell have endeavoured by similar evidence and reasoning, by the evidence of scratched, smoothed, and grooved surfaces of rock, and the appearance of moraine heaps both in the Highlands of Scotland, near Edinburgh, and in Cumberland and Westmoreland, to prove that glaciers antiently covered large tracts of the Caledonian and Cumbrian regions. (*Geol. Proceedings*, 1840, November and December.)

Moreover, it is understood to be the opinion of M. Agassiz that the icy covering thus attempted to be demonstrated by its remaining effects in the mountainous parts of Great Britain, 'once extended over all the north of Europe and the north of Asia and America,' and that in this 'mass of ice the elephants and other mammalia found in the frozen mud and gravel of the arctic regions were imbedded at the time of their destruction.' To the quick melting of this immense mass of ice and the currents of water which resulted, the author attributes the transport and deposition of the 'masses of irregularly rounded boulders and gravel which fill the bottom of the valleys, innumerable boulders having at the same time been transported, together with mud and gravel, upon the masses of the glaciers then set afloat.' (See the work of M. Agassiz entitled *Etudes sur les Glaciers de la Suisse;* and the accounts of his observations before the British Association at Glasgow in 1840.)

Now it is obvious that in examining this speculation, two ways are open: first, a careful comparison of the phenomena with the hypothesis which is proposed for their explanation; secondly, an inquiry into the probability of the conditions which might render such a general and extreme refrigeration of the globe as the hypothesis requires *possible.* Confining our remarks to the former process, we may observe: first, that to admit the antient existence of glaciers in some of the Highlands and Cumberland valleys which display *glacial effects*, is one thing; to admit *glacial action* as the physical cause of the dispersion of boulders and gravel, another. Glaciers are found at this day in corresponding latitudes and at corresponding elevations in the southern parts of America; a local effect of causes which may be conceived to have formerly produced an equal effect in the northern zone: but the distribution of the boulders and gravel is so peculiar and yet so various, the dispersion of them so wide in regions where, according to the present configuration of the land, they could not be pushed by glaciers, nor carried by floating ice; and the connection of these circumstances with a great change of organic life, so strict, that it is hardly conceivable such effects could be due to anything but a cause simultaneously general or successively repeated. Of the physical causes by which the explanation of this great phenomenon has been attempted, it will suffice to mention three:—

1. Great and extensive oceanic action consequent on mighty misplacements of the solid land, and corresponding changes of land and sea.

2. Repeated local displacements of land and sea, and consequent litoral action.

To each of these views has been attached a speculation of the auxiliary agency of floating ice.

3. The melting of great circumpolar glaciers, and the drifting of floating ice.

Our object being to call unprejudiced attention to this subject, we shall only append a few short remarks.

1. The researches of Mr. Smith of Jordan Hill, Captain Bayfield, Mr. Lyell, and others, have shown the probability that in much of the gravel which contains sea-shells, in Northern Europe and America, these shells are not indicative of a warmer but a colder climate than the present.

2. The circumstances under which the extinct mammalia occur in the caverns of tropical Brazil are entirely analogous to those which have been noticed in temperate Europe.

3. The simultaneous gathering of ice over all the northern zone could only happen as a consequence of a *general cooling of the surface of the globe*, and the laws of melting ice are such as to render it almost inconceivable that *even by a rapid change* of temperature such prodigious floods *could be occasioned* as the transport of blocks seems to require; moreover, would not such a rapid change of temperature be excluded by the condition of a previous general refrigeration?

4. The proper course to be now pursued by geologists is to refer to other branches of science the determination of the probability or admissibility of the fundamental assumption of this hypothesis (that the earth has undergone *vicissitudes of temperature* and suffered extensive circumpolar refrigeration); and in the spirit of inductive philosophy, which has hitherto guided their researches, to analyse, classify, and map the boulder formation, so as to arrive at correct inferences regarding the direction, nature, and origin of the forces concerned in producing it.

REGA'LIA, the ensigns of royalty. This term is more especially used for the several parts of the apparatus of a coronation. In England, the regalia properly so called are the crown, the sceptre royal, the virge, or rod with the dove, St. Edward's staff, the orb or mound, the sword of mercy, called Curtana, the two swords of spiritual and temporal justice, the ring of alliance with the kingdom, the armillæ or bracelets, the spurs of chivalry, and sundry royal vestments. The regalia here enumerated, all but the vestments, are preserved in the Jewel-Office in the Tower of London. Before the Reformation in the time of Henry

VIII., they were constantly kept by the religious of the abbey of Westminster; and are still presented before the king on the morning of the coronation by the dean and prebendaries of that church.

In 1649 a complete inventory was made out of the regalia in the Tower, a copy of which may be seen in the additional notes to Taylor's *Glory of Regality*, 8vo., Lond., 1820, p. 312; subsequent to which it is stated that the crowns, according to order of parliament, were 'totallie broken and defaced.' On the restoration of kingly government in the person of Charles II., new insignia were made for his coronation, and these, with the necessary alterations to accommodate them to their successive wearers, and to repair the injuries of time, have continued to the present day.

REGALS (*Regale*, It.), a small portable finger-organ, well known during the sixteenth and seventeenth centuries, and probably much earlier, but not now in use: though Snetzler, the celebrated organ-builder, informed the Hon. Daines Barrington, about the year 1770, that it was not then entirely lost in Germany (*Archæologia*, iii. 32); and till sixty years ago, if not later, there still existed an officer in the royal household called 'Tuner of the Regalls.' In Rees's Cyclopædia this instrument is described as having 'pipes of reeds for convenience of carriage,' an error arising from a mistaken application of the organ-builder's term 'reed stops,' or stops in imitation of hautboys and other instruments blown through a reed.

REGEN, THE CIRCLE OF THE, so called from the name of one of its rivers, is a province of the kingdom of Bavaria, composed of parts of the antient duchy of Bavaria, the Upper Palatinate, the principality of Sulzbach, the territory of Ratisbon, and some other parcels of territory. It lies between 48° 37′ and 49° 44′ N. lat., and between 11° 17′ and 12° 50′ E. long. It is bounded on the north by the circle of the Upper Main, on the north-east by Bohemia, on the south-east by the circle of the Lower Danube, on the south by that of the Isar, on the south-west by that of the Upper Danube, and on the west by that of the Rezat. The area, according to Hassel, is 4170 square miles. The Danube passes through the circle from Ingolstadt to Wirth, and divides it into two unequal parts. The southern portion, which is the smaller, is generally level and very fertile; the eastern and northern part is rugged and mountainous, being traversed by elevations which are partly a continuation of the Fichtelgebirge, and partly of the Bohemian Forest. The soil to the north of the Danube is generally poor, and extensive tracts are covered with sand or with bare uninterrupted rock. Accordingly, though agriculture is followed in the whole circle, it is only to the south that it is extremely productive, and that the finest wheat is grown. To the north, towards the Fichtelgebirge and the Bohemian forest, rye, oats, potatoes, flax, hemp, and hops are grown, and here and there tobacco; but the labour of the husbandman is very severe, and the harvest sometimes fails. The vine is not much grown, for the few vineyards on the Danube are of no importance; fruit too is not cultivated to any extent. The great forests constitute the wealth of the northern part, as they enable the inhabitants to keep up numerous iron-works and glass-houses. The breeding of cattle might be carried on more extensively than it is; that of oxen and swine is most attended to. Fish and game abound. The mineral kingdom is very rich, but no mines are worked except those of iron and coal: those of copper, lead, and sulphur are neglected. There are good quarries of freestone and marble. On the whole there is a more active spirit of industry in this circle than in Bavaria in general. Besides the iron and glass manufactories, there are potteries, paper-mills, and in some districts considerable linen manufactures. The breweries are very important, and the beer of this circle is among the best in Germany. The brandy-distilleries are numerous.

The population is 449,600, of whom a very great majority are Roman Catholics.

REGENSBURG. [RATISBON.]

REGENT, REGENCY. These words, like *rex*, contain the same element as *rego*, 'to rule,' *regens*, 'ruling;' and denote the person who exercises the power of a king without being king, and the office of such a person, or the period of time during which he possesses the power. Wherever there has been hereditary sovereignty, or an hereditary kingly office, it has been found necessary sometimes to have recourse to the expedient of appointing a regent. The cases are chiefly those of (1) the crown devolving on a minor too young to execute any of the duties belonging to it; (2) mental incapacity of the person in whom the sovereignty or kingly office is vested; (3) temporary illness, where there is a prospect of the long continuance of the disease, and of incapacity in consequence; (4) absence from the realm. But in the first case the regent has usually been called in England by the name of Protector: the latest instance being the minority of Edward VI., when his uncle the duke of Somerset was the Protector. By the act of parliament recently passed, Prince Albert is appointed regent during the minority of the princess royal in the event of the demise of the queen, but not with the title of protector. His functions are however the same as those of the protectors of former times, allowing for the changes which have taken place in the English constitution in the course of the last three centuries.

In the earlier periods of English history we have several instances of protectors during minorities, and some of regencies during the temporary absence of the king. The occasional absences of George I. and George II. on visits to their continental dominions rendered the appointment of regents a matter of convenience, if not of necessity. Sometimes the power was put, so to speak, in commission, being held by several persons jointly; but queen Caroline sometimes possessed the functions of regent during the absence of George II.

The nature of this part of the English constitution was however so little understood, and the practice was so imperfectly defined, that when George III. was incapacitated for discharging the duties of royalty on the first occasion when his malady became the subject of public notoriety, a question arose, on which the chief constitutional and political authorities of the time were divided in their judgment. The question was this—whether the heir apparent, being of full age, and the king's eldest son, did not become of right regent. The Whig party of the time, led by Mr. Fox, contended that he did. On the other side, it was maintained that it lay with parliament to nominate the person who should be regent. No regent was at that time appointed, the recovery of the king intervening. When the king was a second time incapacitated, all parties agreed in conferring the title, office, and privileges of regent on the Prince of Wales, then heir apparent. But it was done by parliament, who laid certain restrictions upon him during the first year; but in the event (which event did happen) of the continued incapacity of the king, he was to enter into the full possession of all rights and privileges of king, as if the king were dead, using however only the name of regent, not king: so that in reality the constitution of the country remained unaltered.

The time when the Prince of Wales held the office of regent is the period of English history which will be meant hereafter by the expression 'the regency,' just as 'the regency' in reference to French history denotes the time of the minority of Louis the Fifteenth, when the duke of Orleans was regent. It was during the English regency that the power of Napoleon was broken, and peace was restored to Europe.

REGGIO. [MODENA, DUCHY OF.]

REGGIO. [CALABRIA; RHEGIUM.]

REGIMENT, a body of troops, whether infantry or cavalry, forming the second subdivision of an army; the union of two or more regiments or battalions constituting a brigade, and two or more of the latter making up a grand division or corps d'armée. A regiment is commanded by a colonel, a lieutenant-colonel, and a major, whose several ranks are graduated so as to correspond to those of the general officers commanding the army or division; and when a regiment is divided into two or more battalions, each of these has, at least when complete, its own lieutenant-colonel and major. The word denotes, in general, any government, but it is now applied only to a body of men, indefinite in number, who are subject to military regulations, and immediately under the control of a colonel. The precise period when bodies of men were so designated, for the first time, is uncertain, yet no doubt exists that the common application of the term took place in France after the middle of the sixteenth century.

According to Père Daniel, the first formation of corps of troops corresponding in organization to the modern regiments occurred in the reign of Henry II. of France; and that writer states (*Histoire de la Milice Françoise*, tom. ii., liv. xi.) that, very soon after the battle of St. Quintin (1557), in which the Constable de Montmorenci was defeated and nearly all the French infantry was dispersed, that king issued an ordonnance for the institution of seven legions of foot soldiers, each to consist of 6000 men, who were to be raised, or to do duty, in the frontier provinces of the kingdom. Each of these legions, which was commanded by a colonel, was divided into 15 companies, and to each of the latter were appointed a captain, a lieutenant, and an ensign. [COMPANY.] In this respect the legions differed from those which Francis I. had attempted to raise; for though each of the latter was to have consisted of 6000 men, it was to be commanded by six captains, one of whom only had the title of colonel; and under each captain there were to be two lieutenants and ten centurions. The legions of Henry II. were never completed to the extent prescribed by the ordonnance, and the number of companies in each was, soon after its promulgation, reduced to six.

Though these legions had most of the characteristics of a modern regiment, it appears that they were quite distinct from the bodies of troops which, about the same time, bore this name; and P. Daniel conceives that the regiments were first formed from the companies, or bands, as they were called, of which, from the time of Francis I., or earlier, to that of Henry II., the infantry of France chiefly consisted. Each of these bands was commanded by a captain, who, according to Brantome, was *mestre de camp* over his soldiers; that is, he had no officer above him except the colonel-general of infantry; and the bands were distinguished by the designation of old and new, according to the dates of their formation.

The embodyment of the bands in regiments could not, it is supposed, have been later than 1562, which was in the beginning of the reign of Charles IX.; and Daniel gives, in support of this opinion, the words of the historians Davila and Daubigné, who, in stating the events of the years 1562 and 1563, mention by name the regiments of Picardy and of Brittany; the former writer also, in speaking of the renewal of the civil war in 1567, says that the queen sent in haste for the colonels De Brissac and Strozzi with the *old* regiments. These last are supposed by Daniel to have been the regiments formed of the old bands above mentioned, and to have been so called in contradistinction from others which may have been more recently raised. In proof that regiments then existed independently of the legions, he remarks that, in the registers of the French army for the year 1567, mention is made of an officer who was colonel of the legion of Picardy, and of another who is called colonel of the regiment of Picardy. The regiment of French guards was raised in 1563, by Charles IX., for the defence of his person; and the legions of Guienne and Dauphiné, which had been instituted by Henry II., and disbanded in 1562, were by the same prince restored under the name of regiments, the former in 1567 and the latter in 1568. Charles also organised other regiments, and it is probable that during his reign the denomination became general. The word *terzo*, which according to Sir James Turner (*Pallas Armata*, 1683) was in his time applied by the Spaniards to a regiment, seems to indicate that the numerical strength of the latter was considered as equal to the third part of that of some other body, as a legion.

The time when the name and institution of a regiment were adopted in England cannot be fixed with precision; but Sir James Turner, in the work above quoted, remarks that the word regiment was not then a hundred years old; and if it is meant that the word had been nearly a century in use in this country, it would follow that it was introduced about 1583, or about 20 years after it began to be used in France. In the account of the pay of the officers of the army which was raised by Queen Elizabeth in 1588, when the country was threatened with the Spanish invasion, mention is made of the colonel and lieutenant-colonel of the regiment (Grose, *Military Antiquities*, vol. i., p. 348); and both colonel and regiment occur in Morrison's account of the army in Ireland, in 1598. From the time of that queen's reign the British army has been invariably divided into regiments; and this practice has been followed by all the other nations of Europe.

The army which it was proposed to raise in 1620 for the protection of the Palatinate was to have been formed of 12 regiments of infantry, each consisting of 13 companies, of which the first, or the colonel's company, was to be composed of 200 men, and the others of 150 men; and there were to be 50 troops of horse, each consisting of 100 men. At this time, and perhaps earlier, the word battalion came into general use to denote either the whole or some division of a regiment: Sir Walter Raleigh, in his 'History,' calls the maniples of the Roman troops at the battle of Zama small battaliens. Each of the four regiments of infantry which were raised by Charles I. to serve against the Scots consisted of 1850 men; and, in 1659, during the civil wars in this country, the parliamentary forces consisted of nine regiments of horse, each divided into six troops of 80 men, and 14 regiments of foot, 12 of which consisted of 1200 men, and two of 1100 men, all exclusive of officers. Each of the regiments was divided into ten companies; and there were, besides the regiments, five bodies, each containing 500 men, and three others, each containing 300 men: these eight bodies were called companies, and probably they corresponded to the companies or independent bands in the French army before the institution of regiments.

Soon after the Restoration all the regiments were disbanded; two of them however, one of which is designated the lord-general's regiment of foot and the other his life-guard of horse, were immediately (1661) re-engaged in the service of the crown; and in the same year the Scotch corps or band of 1700 men, which in the time of James I. had gone into the service of France, returned to England. (Daniel, tom. i., liv. x.) This body was then denominated the First or the Royal Regiment of Infantry; and it boasts of being the oldest regular corps in Europe.

In 1684, or near the end of the reign of Charles II., that part of the English army which was assembled near London was reviewed on Putney Heath; and a list of the officers commanding the several regiments is given by Grose (vol. ii., Appendix No. x.). The first named are three troops of horse-guards, which apparently were the lord-general's life-guards above mentioned. These were afterwards disbanded, and instead of them there were raised two troops of horse-grenadier guards; and in 1788, when the latter were reduced, the two regiments of life-guards at the head of the present list of the British regiments were raised. The second at the review was the Earl of Oxford's royal regiment of horse-guards, which was divided into eight troops; and these are the royal horse-guards which constitute the third regiment in the present list. The third was Lord Churchill's regiment of dragoons, which was divided into six troops; and which is at present denominated the First or the King's Dragoon-Guards.

The infantry consisted of the following corps, viz.:—Two battalions of the royal regiment of guards, now called the grenadier guards; one battalion of the Coldstream regiment of guards, which regiment still bears that name; one battalion of the Earl of Dumbarton's regiment, or the royal regiment of infantry above mentioned; and one battalion of the Duke of York's, or the admiral's, maritime regiment. This last, which was named in compliment to the king's brother (afterwards James II.), was subsequently disbanded or converted into a regiment of marines. No other regiments were at the review, but there then existed the queen's regiment of foot, since denominated the queen's royal regiment of infantry: the Holland regiment, which was raised in 1665, and was so designated because it had served in that country. This was then considered as the fourth regiment of infantry, after the two regiments of guards, but it was afterwards and is still designated the third, in consequence perhaps of the reduction of the admiral's regiment. The same regiment is also called the *Buffs*, from the colour of the facings on the dresses of the men. In the year 1684 a regiment of infantry was raised in Ireland; and this appears to have been the seventh, but not being considered as in the pay of England till some years afterwards, and other regiments having in the interval been raised, it became the eighteenth on the list. This is now designated the Royal Irish regiment: the epithet royal having been given to it for its gallant behaviour at the siege of Namur in 1695.

The augmentations which have since taken place in the British army consist of one additional regiment of guards (infantry), called the Scots Fusiliers; of fifteen additional regiments of cavalry, making, exclusive of the guards, sixteen regiments; and, of infantry, as many as make ninety-nine regiments, independently of the foot-guards, the royal regiment of artillery, and the royal corps of marines. Three of the regiments of cavalry, including the first above-mentioned, are heavy dragoons, five are light dragoons, four are hussars, and the remaining four are lancers. Of the infantry regiments, eight are distinguished as light infantry, four are called fusilier regiments, and one, the 60th, is called the king's rifle corps: there is also a rifle brigade in England, and a rifle regiment (of native troops) in Ceylon; a regiment of fencibles at Malta, and three West India regiments (of coloured troops). To these should be added the Honourable East India Company's regiments, a corps of mounted riflemen at the Cape of Good Hope, and the African colonial corps.

As the legions of Henry II. of France bore the names of the several provinces where they were raised, so most of the regiments composing the line of the British army are distinguished by the names of the counties or districts in which the men were enlisted: thus the third is called the East Kent regiment; the fifth, the Northumberland; the sixth, the royal Warwickshire; and so on. The second of the guards also is called the Coldstream regiment.

For the divisions and evolutions of a regiment see BATTALION.

REGIOMONTA'NUS, or, as he styled himself in some of his works, Joannes Germanus de Regiomonte, is the adopted name of a celebrated German astronomer whose real name was Johann Müller. He was born June 6, 1436, but his biographers are not agreed as to the place of his birth. Some say Königsberg in Prussia (Starovolsci); others Königsberg in Franconia (Montucla); De Murr, in his 'Noticia trium Codicum,' afterwards referred to, says, Unfind near Königsberg, in the duchy of Saxe-Hilburghausen; while Doppelmayer and Niceron, followed by Delambre, say Königshofen in Franconia. His adopted name favours the supposition of his birthplace having been Königsberg.

When twelve years old he was sent by his parents to prosecute his studies at Leipzig, but whether he entered the university of that city does not appear. His progress in arithmetic, geometry, and astronomy is said to have been such, that before completing his sixteenth year he could meet with no one sufficiently learned to instruct him in these sciences, which induced him, about 1452-3, to remove to Vienna, where he became the pupil and intimate friend of Purbach, who was at that time professor of astronomy in the university of Vienna. Under Purbach's direction he applied himself zealously to the Greek astronomy, through the medium of such Latin versions of the 'Almagest' as existed; and commenced a series of astronomical observations, including several eclipses and a conjunction of Mars, which last led to the detection of an error of two degrees in the Alphonsine Tables.

Purbach had undertaken a new Latin translation of the 'Almagest,' but dying suddenly, the completion of the work devolved upon Müller. [PURBACH.] Upon Purbach's death (1461), Müller accepted the vacant professorship of astronomy in the university of Vienna, on condition of being permitted to reside for some time in Italy, in order that he might there, in compliance with Bessarion's suggestion, acquire a knowledge of the Greek language.

In 1461-2 he accompanied the Cardinal to Rome, where he began the study of the Greek language, and occupied himself in collecting, collating, and copying Greek MSS., and making astronomical observations, chiefly of eclipses, and where also he made the acquaintance of George of Trebizond, who had anticipated him in a translation of the 'Almagest' from the original, though the work was very imperfectly executed. In 1463, Müller proceeded to Ferrara, where for about a year he continued his philological studies under Blanchini, Theodore Gaza, and Guarino, at the expiration of which time he accepted an invitation from the students of Padua to give in that city a course of instruction explanatory of the astronomical writings of the Arabian philosopher Alfragan. The introductory discourse, entitled 'Oratio in Prælectionem Alfragani Introductoria in Scientias Mathematicas,' &c., delivered by him on this occasion, was prefixed by Melanchthon to his edition of Alfragan, published in 1537. From Padua he proceeded, in 1464, to Venice, to meet Bessarion, with whom he returned to Rome, and shortly afterwards returned to Vienna, where he entered upon the duties of his professorship. While in Italy he composed his work entitled 'De Triangulis Planis et Sphæricis,' first published at Nürnberg, in 1533, fol., 57 years after the author's death, which is now the most interesting of his works. It contained two tables of natural sines, one to a radius 6,000,000, the other to a radius 10,000,000, and by their means all the cases of plain and spherical triangles were solved, without the aid of a similar table of tangents, the utility of which he did not perceive, and the consequence of which oversight was that the solutions, though occasionally very ingenious, are in most cases excessively prolix. The solution of that case of spherical triangles in which, the angles being known, it is thence required to determine the sides, was first given in this work. The trigonometry and the tables of sines appear to have been published separately. The title of the latter, according to Niceron, was 'Compositio Tabularum Sinuum, cum Tabulis Duplicibus Sinuum ejusdem,' Nürnb., 1541, fol. A detailed analysis of the trigonometry is given in the 'Astronomie du Moyen Age,' pp. 292-323 and 347. It affords, says Delambre, a very complete view of what was then known of plane and spherical trigonometry, though the discoveries in this branch of science which belonged exclusively to Müller were not of great importance. While in Italy he likewise detected many errors in Trebizond's version of the 'Almagest,' which he severely criticised. This excited so much animosity, that some have attributed Müller's early death to poison administered to him by one of the sons of Trebizond. (Vossius, *De Scientiis Mathematicis*, p. 184.)

The earliest edition of Purbach and Müller's translation of the 'Almagest' appears to be that of Venice, 1496, fol. It was reprinted at Basle, in 1543, and there are several subsequent editions. The title of the two editions mentioned is 'Joannis de Monte Regio et Georgii Peurbachii Epitome in Cl. Ptolemæi Magnam Compositionem, continens Propositiones et Annotationes quibus totum Almagestum declaratur.' The first six books were the work of Purbach, who makes the length of the sidereal year 365 days, 6 hours, 9 minutes, 12 seconds, which is much nearer the truth than that given by his predecessors. He also states that the obliquity of the ecliptic given by Ptolemy is 23° 51′ 20″, but that, in his own time, he is unable to make it more than 23° 28′, though he does not say whether he considers the obliquity to be decreasing or Ptolemy's result to be erroneous. In all the demonstrations sines are employed to the exclusion of chords. (Delambre.) Upon the whole, this epitome is supposed to have been chiefly extracted from the Latin version which Gerard of Cremona had made of the Arabic commentary of Geber on the 'Almagest.' It appears in effect that both Purbach and Müller rather divined the sense and seized the spirit of Ptolemy than understood the letter of their text. The work was a model of precision, but nevertheless it was an abridgement, and an abridgement of Geber much more than of Ptolemy. (Preface to the French translation of the 'Almagest,' by M. Halma, Paris, 4to., 1813.)

After some years' residence at Vienna, Müller was invited by the king of Hungary (Matthias Corvin) to take up his abode at Buda, where he amused himself with collating the Greek MSS. which had been brought from Athens and Constantinople, and in constructing 'tables of directions,' in which he shows himself no less attached to astrology than to astronomy. The work is entitled 'Tabulæ Directionum Profectionumque, non tam Astrologiæ Iudiciariæ quam Tabulis, instrumentisque innumeris fabricandis utiles' ac necessariæ,' &c., Nürnb., 1475, 4to. It contained the first table of tangents published in Europe, extended however only to each degree of the quadrant. But although similar tables had been constructed by the Arabs, and applied by them to trigonometry full 500 years earlier, Müller, as has been stated, was quite ignorant of this their chief use. The work is reviewed in the 'Astr. du Moyen Age,' pp. 288-92. It may here be observed that the term 'tangents' was not introduced till after the time of Müller. Both by him and Purbach, as by the Arabs, they were called 'shadows,' the length of the shadow of every object cast by the sun being in fact the tangent of the sun's zenith distance, the radius being the vertical height of the object. The state of Hungary induced him, in 1471, to remove to Nürnberg, where he formed an intimacy with a wealthy citizen, Bernard Walter, at whose expense several astronomical instruments were constructed and a printing-office established. With these instruments a series of observations were made which afforded abundant proof of the inexactitude of the Alphonsine Tables. They were published in 1544, under the title of 'Observationes 30 Annorum à J. Regiomontano et B. Walthero. Scripta de Torqueto, Astrolabio Armillari, Regula magna Ptolemaïca, Baculoque astronomico,' Nürnb., 4to. Müller's observations commence at Rome, 3rd January

1462, and at Nürnberg, 6th March, 1472, and terminate 28th July, 1475. Those of Walter begin 2nd August, 1475, and end 3rd June, 1504. Lacaille made use of these observations in the construction of his solar tables. (*Astr. du Moyen Age*, p. 337.) The appearance of a comet led him to compose a work entitled 'Problemata xvi. de Cometæ longitudine, magnitudine, et loco vero,' first published at Nürnberg in 1531, 4to., wherein he gives a method of determining the parallax of a comet, afterwards employed by Tycho Brahé, but which, observes Delambre, though true in theory, cannot be depended on in practice. (*Astron. du Moyen Age*, pp. 340-4.) Prior to 1475, he published his 'Kalendarium Novum,' for the three years 1475, 1494, and 1513 (the interval being an entire cycle of 19 years), which was probably the first almanac that appeared in Europe, though the idea was taken from a similar work composed by Theon of Alexandria. It gives the length of day at all places situated between the parallels of 36° and 55° N. lat.; and for every three degrees of the sun's longitude. On the appearance of this almanac, the king of Hungary presented Müller with 800 (some say 1200) crowns of gold; and such was the demand for it, that, notwithstanding the price of twelve gold crowns, the whole edition was speedily disposed of in Hungary, Italy, France, and England. Besides the above works of his own composition, he had printed an edition of Purbach's 'Theory of the Planets,' the 'Poems' of Manilius, &c., and was proceeding with others, when Pope Sixtus IV., who contemplated a reformation of the calendar, purchased his services by appointing him archbishop of Ratisbon. He immediately quitted his old patron Walter, and proceeded to Rome, in July, 1475, where he died on the 6th July of the following year, in the 41st year of his age. His body was interred in the Pantheon.

Müller, observes Delambre, was a man of remarkable sagacity, and of an ardent and enterprising disposition. He was without contradiction the most learned astronomer that Europe had then produced; though he was inferior to Albategnius as an observer, and to Aboul Wéfa as a calculator. It is matter of astonishment that having recognised the advantage of employing tangents in some few particular cases, he should not have seen the importance of introducing them into ordinary calculations. He had shown the inaccuracy of the Alphonsine Tables, had contemplated their improvement, and had instituted a systematic course of observations for that purpose; time and leisure were alone wanting to the realization of his views. His journey to Rome and premature death occasioned an injury to astronomy which it required a long interval to repair.

The following list of his work[illegible]ot already mentioned, is taken from the list given by Delambre, in the 'Biog. Univers.,' compared with that given by Niceron With the exception of the first two, they were all published after his death:—1, 'Disputationes contra Cremonensia in planetarum theoricas deliramenta,' Nürnb., 1474, fol. 2, 'Tabula magna primi mobilis,' Nürnb., 1475. 3, 'Almanach, ab anno 1489 ad annum 1506.' 4, 'In Ephemerides Commentarium,' Venice, 1513, 4to. 5, 'Tabulæ Eclipsium Purbachii. Tabulæ primi mobilis à Monteregio,' Venice, 1515, fol. 6, 'Epistola de compositione et usu cujusdam meteoroscopii armillaris,' Ingolstadt, 1533, fol. (appended to an edition of Apian's 'Introduction to Geography'). 7, 'Problemata 29 Saphea nobillissimi instrumenti à I. de Monteregio,' Nürnb., 1534. (The Saphea bore some resemblance to the Analemma.) 8, Mahometis Albategnii de Scientia Stellarum Liber, Latinè ex Arabico per Platonem Tiburtinum versus, et additionibus aliquot Joannis Regiomontani illustratus,' Nürnb., 1537, 4to. (Niceron). 9, 'De Ponderibus et aquæductibus, cum figurantibus Instrumentorum ad eas res necessariorum,' Marpurgi, 1537, 4to. 10, 'Tabulæ Revolutionum,' 4to. n. d. 11, 'De Influentiis Stellarum,' Argentorati, 1538. 12, 'Problemata Astronomica ad Almagestum spectantia,' Nürnb. 1541 (Niceron). 13, 'Fundamenta operationum quæ fiunt per tabulam generalem,' Idem., 1557, fol.

Three MSS., in Müller's handwriting, came into De Murr's possession. One consisted of notes on the Latin version of Ptolemy's Geography. The second was his defense of Theon against Trebizond. The third was entitled 'De Triangulis omnimodis Liber V. Extracts from these were published by De Murr, under the title of 'Noticia trium codicum autographorum Johannis Regiomontani,' Nürnb., 1801, 4to. Müller's Letters were also published by De Murr in 1786, in his 'Memorabilia Bibliothecarum publicarum Norimbergensium et Universitatis Altdorfianæ,' tome i., pp. 74-205. See also 'Astron. du Moyen Age,' pp. 344-65. Weidler, in his 'Historia Astronomiæ,' pp. 310-313, gives a list of the works which issued from Müller's press at Nürnberg, and also of those which he contemplated publishing.

(Montucla, *Histoire des Mathématiques*, and the works above quoted. The reader may further consult the *Life of Müller* by Gassendi, appended to his *Life of Tycho Brahé*, Paris 1654, 4to.; Fabricius, *Bibliotheca Latina Mediæ et Infimæ Latinitatis*, tom. iv., p. 353; *Pauli Jovii Elogia*, No. 144.)

REGISTER, REGISTRATION, REGISTRY. In feudal times, the owner of land, or at least the person immediately entitled to the profits arising from it, was usually the occupier, and his right was notorious among his neighbours; for in their presence possession or *seisin* of the land was delivered to him upon the spot by the lord; they signed the instrument, which was evidence of the grant, and they formed part of the lord's court, in which the grant was usually recorded. [CONVEYANCING.]

But this simple method of conveyance was in the course of time found insufficient for the more complicated circumstances of society. Land by improved cultivation became more productive, and the profits arising from it were devoted to more extensive purposes than when a large proportion of every great estate was waste. Leases of land then became more common, and as the lessee was of course in actual possession of the premises, possession ceased to be sufficient evidence of absolute property in land. Purchasers therefore now require not only proof of possession and production of the instrument by virtue of which the apparent proprietor holds the land, but also an investigation of the *title-deeds*, or documents which form the history of the land; lest any one should hereafter be produced which should be destructive of the claim of the supposed owner, and therefore of the title of those who derive their rights from him. Thus the evidence of a right to land, or to the profits arising from land, consists partly of possession, partly of the facts disclosed by the written documents or *title-deeds* relating to it, and hence partly again of the possession of the title-deeds themselves.

But there are many interests in land which exist without either of these protections. For instance, A, who is supposed by all his neighbours to be the owner of an estate which he derives from his ancestors, and has occupied since his father's death, mortgages the land to B for a sum far less than its value: he delivers the title-deeds to B, but (as is usual) retains the possession and entire enjoyment of the land by paying regularly the interest on the mortgage, and being supposed well able to pay the principal money when demanded. A then mortgages the estate a second time to C, to whom he gives notice of the prior incumbrance to B, and thus accounts for the absence of the title-deeds, which C investigates in B's hands. Here we observe that C has an interest in the land, without the security which either possession or the holding of the title-deeds gives A has the one, B the other. We will suppose the two sums for which the estate is mortgaged to be nearly equal to its value. A borrows a further sum upon it from D, whom he informs of B's mortgage, but not of C's; and in case of dispute the Court of Chancery has to decide between the mortgagees. This would be an easy task if the rule of equity were undeviating, that priority of time gives superior right (qui prior est tempore potior est jure); but the rule that where equities are equal, law shall prevail, destroys the simpler maxim. The two last mortgagees, C and D, have, we may suppose, only an equitable interest in the land, A having granted it at the time of the first mortgage to a trustee for many hundred years, in order that the stipulations of the mortgage-deed shall be fulfilled. [MORTGAGE.] This is called creating a term of years, and it has the effect of protecting the estate from any acts done subsequently to the creation of the term, and inconsistent with the objects for which it exists. Those terms which have not merged or otherwise ceased are called *outstanding terms*. Now if, in the case supposed, D pays off B, and takes an assignment of his mortgage and of the outstanding term; if, to use the technical phrase, he 'tacks' B's security to his own, he unites in himself equal equity with C, and also the legal right which the term gives him; and then he takes precedence of C, who loses the sum which he had advanced, unless indeed he too can find and obtain the assignment of an outstanding term created by one of A's ancestors antecedently to B's. But the case may be more complicated, and the means of fraud still further extended. A dies; and then comes to light a settlement made by his father, to which A was himself a party, which shows that A was entitled to the estate only during his life, that the course in which it should go after his death had been clearly defined, and that it had been conveyed, by his father and himself, to trustees for this purpose. This discovery destroys the estates of B, C, and D alike. These cases, or cases partaking of the character of these, whether the result of ignorance, or accident, or fraud, are frequent sources of litigation: they arise from the facility afforded for the concealment of deeds by the present system of conveying land; and besides the direct injury which they do to the individuals involved in them, they produce a feeling of insecurity concerning the titles to land, which, joined to the difficulty, often the impossibility, of proving titles, especially by descent, renders the alienation of land or the raising of money upon it difficult and costly. Again the advantage derived from obtaining an assignment of outstanding terms causes a conveyancer to investigate the various transfers and transmissions of them with as much care as the title to the fee; and as it may be safest to obtain the assignment of as many outstanding terms as can be procured, and especially of the most antient, there are a variety of claims to an interest in an estate, all to be proved by the seller, and investigated by the purchaser. The deed too assigning the term is usually distinct from the conveyance of the fee, and is often of great length. Hence vast additional expense is incurred in the sale and mortgaging of land.

But supposing it to be certain that no concealed charge affects land, it may happen that the undoubted owner of it may be unable to prove his right from want of the title-deeds. N possesses an estate, which may be a small part of a much larger estate, of which the owner, M, retains the title-deeds, giving to N authenticated or *attested copies* of them, and a covenant that he, M, when required, will produce the originals. But M sells the estate, and the title-deeds pass into hands not bound by the *covenant to produce;* or he dies, and his representatives are unknown; or again, N himself sells his portion of the estate, and he cannot transfer the benefit of his covenant [COVENANT]; or, by a multitude of accidents, the deeds or some of them are lost. In these cases the estate is unmarketable. Indeed instances have been known where the mere expense of giving attested copies of deeds, which a person who had contracted to sell an estate was bound to furnish, has exceeded the value of the estate.

The Real Property Commissioners have expressed their opinion that a large proportion of all the land in the country is unmarketable, either from the fear of latent incumbrances, or from the inability of the owner to produce his title-deeds. Prior incumbrances are indeed somewhat assisted by the doctrine of courts of equity, that if a subsequent purchaser or mortgagee has notice of the previous charge before his own transaction with the estate, he shall not by any device obtain priority over that charge. But notice does not necessarily imply knowledge. [NOTICE.] Notice may be an actual direct intimation of a fact given to the party or his agents, which is called *actual notice;* or it may be only something leading a discreet person to an investigation, which would enable him to discover the fact: thus the existence of a suit (lis pendens) touching the land affects the purchaser or mortgagee with notice. This latter class of notice is called *constructive;* it is so vague as to be easy of proof, and difficult to avoid; and one consequence of the admission of it in a court of equity is, that solicitors often think it their duty to avoid investigations which might lead to constructive notice, and so endanger the priority of their client's security.

These remarks may assist the unprofessional reader in understanding the use of a general register of deeds, a subject which the Real Property Commissioners declare to exceed in importance all others submitted to their inquiry. To this subject they have devoted their Second Report, and they unanimously recommend the establishment of a General Public Register for England and Wales of all deeds or instruments affecting land, in order to secure titles against the loss or destruction, or the fraudulent suppression or accidental non-production of instruments; to simplify titles by rendering in most cases needless the assignment of outstanding terms; to protect them from the consequences of constructive notice; and to render conveyances shorter and more simple.

To a certain extent such registers have been already established in England. By the 27 Henry VIII., c. 16, it is enacted that all bargains and sales of land shall be inrolled. [BARGAIN AND SALE.] The 2 & 3 Anne, c. 4 (amended by 5 Anne, c. 18) directs that a memorial of all deeds, conveyances, and wills concerning any lands in the West Riding of Yorkshire may, at the election of the parties, be registered; and that any conveyance or will affecting the same lands shall be deemed void against a subsequent conveyance unless a memorial shall be registered. The 6 Anne, c. 35, recites that 'lands in the East Riding of York, and in the town and county of the town of Kingston-upon-Hull, are generally freehold, which may be so secretly transferred or conveyed from one person to another, that such as are ill disposed have it in their power to commit frauds, and frequently do so, by means whereof several persons (who, through many years' industry in their trades and employments, and by great frugality, have been enabled to purchase lands, or to lend moneys on land security) have been undone in their purchases and mortgages by prior and secret conveyances and fraudulent incumbrances; and not only themselves, but their whole families thereby utterly ruined:' and then the act establishes a register of the memorials of deeds and wills in the East Riding of Yorkshire. The 7 Anne, c. 20, establishes such a register for Middlesex; and the 8 George II., c. 6, establishes one for the North Riding of Yorkshire, and provides that deeds, wills, and judgments affecting land may be registered at length, instead of the registration of mere memorials of them. In the Bedford Level too there is a registration of all deeds affecting land there. These registers, owing to the insufficiency of their indexes, and to some other defects, do not answer all the purposes which might be expected from them, and in many respects their arrangements are cumbrous and expensive: nevertheless (as the Commissioners remark) no one has proposed to abolish them. A registration of wills has long been established in the ecclesiastical courts [PREROGATIVE COURT], not certainly upon a good plan, since it is not always possible to say beforehand in what court a will has been proved, but nevertheless with great advantage. The recent act for Abolishing Fines and Recoveries (3 & 4 Wm. IV., c. 74) substitutes for them a deed which is inrolled in the Court of Chancery. In Ireland, in the Colonies, in most of the United States, in Sweden, France, and Italy, and in many of the German States, registers are established. Nor is it found that the disclosures which a register makes of the state of landholders' property produce inconvenience, even supposing such disclosures inseparable (which they a[illegible]ot) from all systems of registration. It is obviously for [illegible] public benefit that the apparent extent of a person's landed property should not induce men to give him a credit to which the actual amount of that property does not entitle him.

As the plan of register proposed by the commissioners has not yet been adopted, it will be only necessary briefly to indicate its main provisions. They propose to register every document transferring any estate in land or charge upon it, excepting such as relate to copyholds, and leases for not more than twenty-one years, accompanied by possession. Thus contracts concerning land (with certain limitations), liens upon it, judgments, crown debts, decrees in equity, pending suits and appeals, should all form matters of registration. They recommend that all deeds should be registered at length; indeed that the original deeds should be deposited at the Registry, and that (unless in special circumstances) office-copies of them shall be admitted as evidence. They propose that the register should not be classified according to the names of individuals, but that to the registered deed relating to an estate a symbol shall be attached indicative of that estate, under which symbol all subsequent documents affecting it will be entered. The system admits of opening a fresh series of entries, or, in other words, commencing a new title for any portion of the estate which may be separately conveyed, references being made from each to the other. And thus again many separate estates might be united under one symbol. Indexes should be prepared both of the symbols and of persons: and to facilitate reference, England and Wales should be divided into districts, usually corresponding in limits with the counties. Separate indexes should be made to wills, judgments, &c.

It is the opinion of the commissioners that if a register is established, it ought to be taken as sufficient notice of the documents registered; and that on the other hand default of registration ought not to be remedied by any proof even of actual notice. With this view they recommend that persons should have liberty to register contracts, to enter caveats during the interval between the execution of the deed and its registration, and inhibitions which shall prevent owners of estates who enter them from dealing with the estate pending such inhibition.

The act 1 and 2 Victoria, c. 110 (abolishing arrest on mesne process, except in certain cases) provides (§ 19) that no judgment of the superior courts or decree of the courts of equity shall affect lands unless a memorandum of such judgment, &c. shall be registered with the senior master of the Court of Common Pleas, who shall enter it under the name of the person whose estate is to be affected by it. The 2 and 3 Vic., c. 11, enacts that these registered judgments shall not be valid for a longer space than five years, but it provides that the entry of them may be renewed; it also enacts that no pending suit (lis pendens) shall affect the purchaser or mortgagee with notice, unless a similar memorandum is registered by the same officer, under the head of the person whose estate is affected by it, and the entry must be renewed every five years; and thirdly the act requires crown debtors to be registered in the same office, and provides means for obtaining and recording their discharge from their liabilities to the crown; but the act does not require the renewal every five years of the entry in this case.

(*Second Report of Real Property Commissioners; and the Works therein cited;* Tyrrell's *Suggestions for the Laws of Real Property.*)

REGISTER ACT. [SHIPPING.]

RE'GIUS MORBUS, as used by the classical Latin authors, must not be confounded with the *King's Evil*, or *Regius Morbus*, of the writers of the middle ages. In the former it means jaundice (Horat., *Art. Poet.*, 453), called also ἴκτερος, 'morbus arquatus,' and 'aurugo' (or 'aurigo'); in the latter it means scrofula. [SCROFULA.] The derivation of the term as applied to jaundice is both uncertain and unsatisfactory. According to Serenus Samonicus (*De Medic.*, cap. 58, v. 1033)—

> '*Regius* est vero signatus nomine morbus,
> Molliter hic quoniam celsa curatur in aula.

Varro (apud Plin., *Hist. Nat.*, lib. xxii., cap. 53, ed. Tauchn.), '*Regium* cognominatum morbum arquatum tradit, quoniam mulso curatur;' 'Scilicet,' (says Doering ad Horat., *loc. cit.*), '*mulsum* (vinum mello conditum) pertinet ad delicias, quas reges imprimis et beatiores appetunt et facile sibi comparare possunt.' The same derivation is given by Celsus (*De Medic.*, lib. iii., cap. 24), who says the cure is to be attempted by various kinds of exercises: 'Lecto etiam et conclavi cultiore, lusu, joco, ludis, lascivia, per quæ mens exhilaretur, ob quæ *regius* morbus dictus videtur.' Blan[illegible]rdus (*Blanckaert*, or *Blankaard*) in his 'Lexicon Medicum,' is rather inclined, 'ab *auro*, metallorum *rege*, denominationem statuere, sicut et *Aurigo*, ab *auri* colore.' Dr. Good (*Study of Medicine*) says, 'the meaning of *Regius*, as expounded by Celsus, will, I apprehend, content very few;' he then remarks that this and the two other Latin names of the disease (*Arquatus Morbus*, and *Aurugo*) 'are not indeed univocals, but very clearly equivalents, and equally import *gold, golden crown, golden bow*, or *circumfusion;* the colour of the disease, and its encompassing the body.' Each of these derivations appears somewhat far-fetched and unsatisfactory, and the term is probably one of those of which no plausible explanation can be given.

REGRATING. A regrator is defined (6 Ed. VI., c. 14) to be one who buys in a fair or market the various articles specified by the act; which are principally articles of provision, and sells them again in the same, or in any other fair or market within four miles. That statute and others providing certain penalties for such acts have all been repealed by 12 Geo. III., c. 7. Whether or not regrating is an offence at common law is doubtful; and at all events to make it so the act must be done with intent to raise the price of provisions. (Burn's *Justice*, tit. 'Forestalling.')

REGULAR CLERGY. [CLERGY.]

REGULAR FIGURES, POLYGONS, SOLIDS, POLYHEDRONS. We have here to add to what is said in POLYGON AND POLYHEDRON all that concerns the regular figures or solids, not as to their general properties, but as to the proportions of their parts and the mode of describing them. We shall take first the plane figures, and then the solids.

A regular polygon, meaning one of which all the sides are equal and all the angles are equal, may have any number of sides from three upwards. The Greek terms trigon, tetragon, pentagon, hexagon, heptagon, octagon, nonagon, decagon, undecagon, dodecagon, are in use (except the two first) to express polygons of three, four, &c., up to twelve sides. The term quindecagon is in use to express the polygon of fifteen sides.

Let the polygon be described, having n sides: let its side be a, its area V, and let r and R be the radii of the inscribed and circumscribed circles. The formulæ which connect these quantities are then as follows:—Let ν stand for the nth part of 180°, then

$$a=2R\sin\nu=2r\tan\nu,$$

$$V=\frac{na^2\cot\nu}{4}$$

which are enough to determine the remaining three of V, a, R, r, when one of them is given. To facilitate the determination and construction of any regular polygon not having more than twelve sides, we take the following table from James Dodson's 'Calculator' (1747), which is correct to every figure as far as we have thought it necessary to examine it. The author generally corrected errata with his own pen in every copy, and the one before us has his corrections:—

When the Length of Side = 1.

No. of Sides.	Radius of Circumscribed.	Radius of Inscribed.	Area.
3	0·5773503	0·2886751	0·4330127
4	0·7071068	0·5000000	1·0000000
5	0·8506508	0·6881910	1·7204774
6	1·0000000	0·8660254	2·5980762
7	1·1523825	1·0382617	3·6339124
8	1·3065630	1·2071068	4·8284271
9	1·4619022	1·3737387	6·1818242
10	1·6180340	1·5388418	7·6942088
11	1·7747329	1·7028437	9·3656404
12	1·9318516	1·8660254	11·1961524

When Radius of Circumscribed Circle = 1.

No. of Sides.	Length of Side.	Radius of Inscribed.	Area.
3	1·7320508	0·5000000	1·2990381
4	1·4142136	0·7071068	2·0000000
5	1·1755705	0·8090170	2·3776412
6	1·0000000	0·8660254	2·5980762
7	0·8677674	0·9009689	2·7364102
8	0·7653668	0·9238795	2·8284271
9	0·6840403	0·9396926	2·8925437
10	0·6180340	0·9510565	2·9389263
11	0·5634651	0·9594931	2·9735250
12	0·5176381	0·9659259	3·0000000

When Radius of Inscribed Circle = 1.

No. of Sides.	Length of Side.	Radius of Circumscribed.	Area.
3	3·4641016	2·0000000	5·1961524
4	2·0000000	1·4142136	4·0000000
5	1·4530851	1·2360680	3·6327128
6	1·1547005	1·1547005	3·4641016
7	0·9631491	1·1099160	3·3710222
8	0·8284271	1·0823919	3·3137084
9	0·7279405	1·0641776	3·2757315
10	0·6498394	1·0514622	3·2491970
11	0·5872521	1·0422172	3·2298913
12	0·5358984	1·0352760	3·2153904

When Area = 1.

No. of Sides.	Length of Side.	Radius of Circumscribed.	Radius of Inscribed.
3	1·5196716	0·8773827	0·4386912
4	1·0000000	0·7071068	0·5000000
5	0·7623870	0·6485251	0·5246678
6	0·6204033	0·6204033	0·5372849
7	0·5245813	0·6045183	0·5446520
8	0·4550899	0·5946034	0·5493420
9	0·4201996	0·5879764	0·5525172
10	0·3605106	0·5833184	0·5547687
11	0·3267617	0·5799148	0·5564242
12	0·2988585	0·5773503	0·5576775

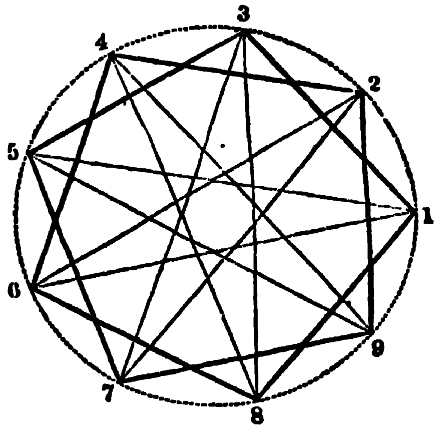
By means of these tables the construction of any figure is immediately reduced to a short calculation, the drawing of a circle, and setting off equal chords on that circle, the compasses and a scale of equal parts being all the instrumental aid necessary. It is required to construct, for example, a regular heptagon, or figure of seven sides, with an area of 225 times the square on one of the larger divisions of the scale. The side and radii must therefore be increased in the fourth table in the proportion of $\sqrt{225}$ to $\sqrt{1}$, or of 15 to 1. And

$\cdot 5245813 \times 15 = 7\cdot 8687$ side.
$\cdot 6045183 \times 15 = 9\cdot 0678$ rad. circum.
$\cdot 5446520 \times 15 = 8\cdot 1698$ rad. inscr.

If the two circles be carefully drawn from the same centre, and chords equal to the side taken off, the compasses will be found to be carried exactly seven times upon the larger circle, and the chords, being drawn, will be found to touch the inner circle. and any little error of construction will be better shown by failure of touching the inner circle correctly than by any other means.

The above presumes that it is desired to proceed as accurately as possible; but for rough work, and when the circumscribed circle is known, the proportional compasses, or even a common pair of compasses and trial, will succeed perfectly well. The proportional compasses have a scale for the adjustment of the pivot in such manner that when the opening at one end is the radius of a circle, that at the other end shall be the side of the inscribed polygon of a given number of sides.

The regular polygons hitherto treated have been those of Euclid, without any re-entering angles. The star-shaped polygons (which, though equilateral and equiangular, do not come within Euclid's definition) are described by drawing a regular polygon of the same number of sides, and drawing successive diagonals so as to cut off a number of sides which is prime to the number of sides of the polygon.



Thus if 12, 23, 34, &c. be the sides of a regular nonagon, or nine-sided polygon, it follows that there are two regular star-shaped nonagons, one made by diagonals which cut off 2 or 7 sides, and one made by diagonals cutting off 4 or 5 sides. Diagonals cutting off three sides would give three equilateral triangles, but no nonagon at all. These nonagons are 1357924681, and 1594837261. Star-shaped dodecagons are also only one in number, since 5 and 7 are (except 1 and 11, which would only give the dodecagon of Euclid) the only numbers less than 12 which are prime to 12. But a regular polygon of 13 sides has 5 star-shaped polygons, made by diagonals cutting off 2 and 11, or 3 and 10, or 4 and 9, or 5 and 8, or 6 and 7 sides.

We now come to the subject of regular polyhedrons, presuming the reader to know the contents of the article POLYGON AND POLYHEDRON. A great many properties of these solids have been investigated, but as they are of little use, it will be unnecessary to do more than show the relations of their parts, the radii of the inscribed and circumscribed spheres, and the solidities and surfaces: with tables for constructing them of given dimensions. Let a solid be contained by f faces, each of which is a regular polygon of n sides. Let c be the number of corners or solid angles, e the number of edges, and m the number of angles which meet at a corner. Then since there are c corners with m angles at each, the number of edges, counting each edge as often as it meets a corner, is mc; or, as each edge meets a corner twice, $\frac{1}{2}mc = e$, the number of distinct edges. Again, since there are f faces, of n sides each, and every edge is the union of two faces, we have $\frac{1}{2}nf = e$. But $f + c = e + 2$, or

$$\frac{2e}{n} + \frac{2e}{m} = e + 2, \text{ or } e = \frac{2mn}{2m + 2n - mn}$$

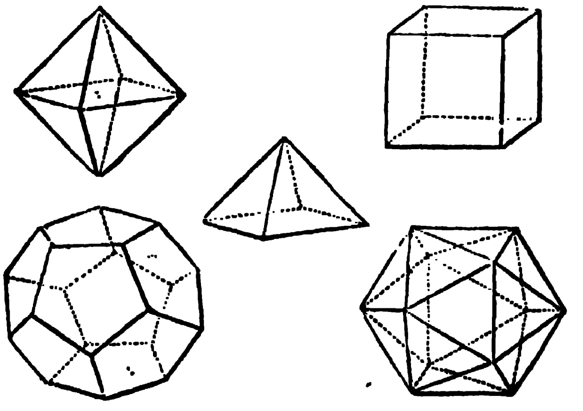
which must be a whole number. And neither m nor n can be less than 3, nor greater than 5, for there are no figures of fewer sides than 3, and [POLYGON AND POLYHEDRON] spaces cannot be inclosed entirely by figures of more than five sides. The rest follows from the properties of conjugate solids in the same article.

Let $n=3$, or $e = 6m \div (6-m)$. This is a whole number (1) when $m=2$; this must be rejected: (2) when $m=3$, giving $n=3$, $m=3$, $e=6$, $f=4$, $c=4$, or four triangles; we have here the regular tetrahedron, or triangular pyramid: (3) when $m=4$, giving $n=3$, $m=4$, $e=12$, $f=8$, $c=6$, or eight triangles; we have here the regular octohedron: (4) when $m=5$, giving $n=3$, $m=5$, $e=30$, $f=20$, $c=12$, or 20 triangles; we have here the regular icosahedron.

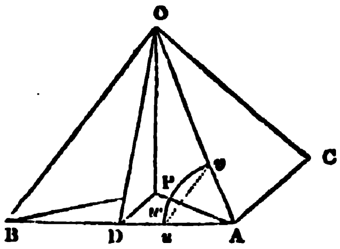
Let $n=4$, or $e = 8m \div (8-2m)$. This is a whole number (1) when $m=2$; which reject: (2) when $m=3$, giving $n=4$, $m=3$, $e=12$, $f=6$, $c=8$, or six squares; we have here the regular hexahedron, or cube, the only one of its kind.

Let $n=5$, or $e = 10m \div (10-3m)$. This is a whole number (1) when $m=2$; which reject: (2) when $m=3$, giving $n=5$, $m=3$, $e=30$, $f=12$, $c=20$, or 12 pentagons; we have here the regular dodecahedron, the only one of its kind.

We have thus the five regular solids, and have shown that there can be no others.



The centre of a regular polyhedron is obviously the point of intersection of lines drawn from the corners, each inclined at the same angle to all the edges which meet it. The radius of the circumscribed sphere (R) is the line drawn from any corner to the centre; that of the inscribed sphere (r) is the perpendicular let fall from the centre upon any of the faces. Let O be the centre, A any corner, AB and AC adjacent sides of one of the faces passing through A, and let OP be the perpendicular. Let a be the side of the polygon, $2x$ the angle BOA subtended by any edge BA, and y the angle made with OP by the line OD bisecting BOA.



$$\text{Let } \frac{180^\circ}{n} = \nu,\ \frac{180^\circ}{m} = \mu.$$

$$\text{Now DPA} = \frac{1}{2}\,\frac{360^\circ}{n} = \nu.$$

The angle of the planes DAO, OAP, is half of an angle *m* of which meeting at A make four right angles, it is therefore $360^\circ \div 2m$, or μ. And drawing the right angled spherical triangle which represents the solid angle AD, AP, AO, we see that its angle at v is μ, the side wu is $90^\circ - \nu$, and the hypothenuse vu is $90^\circ - x$. Hence

$$\sin(90^\circ - \nu) = \sin(90^\circ - x);\ \sin\mu \text{ or } \cos x = \frac{\cos\nu}{\sin\mu}.$$

But the angle at u is $90^\circ - y$, whence

$$\cos\mu = \cos(90^\circ - \nu)\,\sin(90^\circ - y);\ \text{or } \cos y = \frac{\cos\mu}{\sin\nu}.$$

The determination of x and y, angles depending only on the number of sides of the polygon and the number of angles which meet at each corner, settles every question. We have

$$a = 2\mathrm{R}\sin x \quad \ldots\ldots (1)$$

$$r = \mathrm{OD}\cos y = \mathrm{R}\cos x\cos y = \mathrm{R}\cot\nu\cot\mu \ \ldots (2).$$

The superficies (S) of the solid is f times the superficies of one face, or

$$\mathrm{S} = f.\,\frac{na^2\cot\nu}{4} = nf\mathrm{R}^2\sin^2 x.\,\cot\nu \ \ldots (3).$$

The solidity or volume (V) is the superficies multiplied by the third part of r, or

$$\mathrm{V} = \tfrac{1}{3}\,nf\mathrm{R}^3\sin^2 x.\,\cot^2\nu.\,\cot\mu \ \ldots\ldots (4).$$

The angle of two faces with a common edge is $180^\circ - 2y$. We also see that in conjugate solids [Polygon and Polyhedron] the angles x and y are inverted, the value of x in one being that of y in the other, and *vice versâ*.

The following are the values of μ and ν in the several solids:—

Tetrahedron $\mu = 60^\circ$, $\nu = 60^\circ$ $\cos\mu = \cos\nu = \frac{1}{2}$.

Hexahedron $\mu = 60^\circ$, $\nu = 45^\circ$ $\cos\nu = \frac{1}{2}\sqrt{2}$.

Octohedron $\mu = 45^\circ$, $\nu = 60^\circ$.

Dodecahedron $\mu = 60^\circ$, $\nu = 36^\circ$ $\sin\nu = \frac{1}{2\sqrt{2}}\sqrt{(5 - \sqrt{5})}$.

Icosahedron $\mu = 36^\circ$, $\nu = 60^\circ$.

These formulæ will enable any one to verify the various expressions with which old books of geometry abound. The following table answers to that for polygons, and is taken from the same source:—

When the Side = 1.

Solid.	Radius circumscribed.	Radius inscribed.	Superficies.	Volume.
Tetrahedron .	0·6123724	0·2041241	1·7320508	0·1178511
Hexahedron .	0·8660254	0·5000000	6·0000000	1·0000000
Octohedron .	0·7071068	0·4082483	3·4641016	0·4714045
Dodecahedron	1·4012585	1·1135164	20·6457280	7·6631188
Icosahedron .	0·9510565	0·7557613	8·6602540	2·1816951

When Radius of Circumscribed Sphere = 1.

Solid.	Sine.	Radius inscribed.	Superficies.	Volume.
Tetrahedron .	1·6329932	0·3333333	4·6188023	0·5132002
Hexahedron .	1·1547005	0·5773503	8·0000000	1·5396006
Octohedron .	1·4142136	0·5773503	6·9282032	1·3333333
Dodecahedron	0·7136442	0·7946545	10·5146223	2·7851639
Icosahedron .	1·0514622	0·7946545	9·5745413	2·5361507

When Radius of Inscribed Sphere = 1.

Solid.	Side.	Radius circumscribed.	Superficies.	Volume.
Tetrahedron	4·8989795	3·0000000	41·5692192	13·8564064
Hexahedron	2·0000000	1·7320508	24·0000000	8·0000000
Octohedron	2·4494897	1·7320508	20·7846096	6·9282032
Dodecahedron	0·8980560	1·2584086	16·6508731	5·5502910
Icosahedron	1·3231691	1·2584086	15·1621684	5·0540561

When the Superficies = 1.

Solid.	Side.	Radius circumscribed.	Radius inscribed.	Volume.
Tetrahedron .	0·7598357	0·4653025	0·1551008	0·0517003
Hexahedron .	0·4082483	0·3535534	0·2041241	0·0680413
Octohedron .	0·5372850	0·3799178	0·2193457	0·0731152
Dodecahedron .	0·2200822	0·3083920	0·2450651	0·0816884
Icosahedron .	0·3398080	0·3231774	0·2568144	0·0856048

When the Volume = 1.

Solid.	Side.	Radius circumscribed.	Radius inscribed.	Superficies.
Tetrahedron .	2·0395489	1·1547006	0·4163417	7·2056240
Hexahedron .	1·0000000	0·8660254	0·5000000	6·0000000
Octohedron .	1·2848990	0·9080604	0·5245576	5·7191069
Dodecahedron .	0·5072221	0·7107492	0·5648000	5·3116140
Icosahedron .	0·7710254	0·7332887	0·5827111	5·1483486

REGULUS, M. ATILIUS. [Punic Wars.]

RE'GULUS. [Sylviadæ.]

RE'GULUS. A line drawn from the pole star, not through the two pointers, but between them and the five secondary stars of the Great Bear, which lie near them, will pass through the bright star called *α Leonis*, or Cor Leonis (the lion's heart). By Ptolemy and other Greeks it was called βασιλίσκος, whence comes the Latin name Regulus, a word which is the diminutive of *rex*.

REICHA, ANTOINE, a well-known composer, though more esteemed as a writer on music, was born at Prague in 1770, but educated at Bonn under his uncle, where he at first clandestinely studied the art passionately loved by him, and which soon became his profession; from which acknowledgment, made by himself, it is to be presumed that he was originally intended for a different pursuit. He early attempted musical composition, and when only seventeen years of age conducted the performance of his first symphony. In 1794 he went to Hamburg, and there remained five years, applying much to the abstruse theory of music, for which study his knowledge of algebra, a branch of mathematics wherein he was highly skilled, eminently qualified him. At the same time he also devoted great attention to the French language, in which he composed an opera in two acts. In 1799 he proceeded to Paris, and at the celebrated concert *de Cléry* produced with decided success a grand symphony. He afterwards took up his residence at Vienna, where he wrote many of his works, and among them thirty-six fugues for the piano-forte, the whole edition of which was sold in the first year. He returned to Paris in 1808, and there remained till his decease, which took place in 1836.

M. Reicha was a member of the Institute in both its forms, and a very leading professor of composition at the *École Royale de Musique*. Among his numerous works, those on which his future fame will rest are, *Cours de Composition, ou Traité complet et raisonné d'Harmonie Pratique*, in 1 vol. folio; and *Traité de Mélodie, Abstraction faite de ses Rapports avec l'Harmonie*, in 2 vols. 4to., '814, both of which ought to be carefully studied by every musician who wishes to understand his art otherwise than empirically.

REICHENBACH, now the chief town of a circle in the government of Breslau in Silesia, was the capital of a government of the same name, which was abolished and annexed to the government of Breslau by a cabinet order of the 3rd of February, 1820. It is surrounded by a double wall and moat, and has four gates and four suburbs. There are a Roman Catholic and a Protestant church, a Catholic and 2 Protestant schools, a synagogue, and a drawing-school or mechanics. The inhabitants, nearly 5000 in number, manufacture linen, woollen, cotton, canvas, muslin, &c. This town is remarkable for the action fought in its vicinity on the 16th of August, 1762, in which the duke of Brunswick-Bevern defeated the Austrians under Marshal Daun, who was coming to the relief of Schweidnitz: and for the convention concluded in 1790 by the ambassadors of England, Holland, Poland, Prussia, and Austria, by which the further existence of the Turkish empire was secured, which Austria and Russia wished to destroy.

REICHENBERG, the largest and most flourishing town in the kingdom of Bohemia next to Prague, is situated in the north part of that kingdom, in the circle of Bunzlau, on the river Neisse, 52 miles north-north-east of Prague. It is the capital of a lordship belonging to Count Claus-Gallas, which contains thirty-seven other places, some of which are considerable. The principal buildings are, three churches, two palaces, a theatre, and the handsomest and largest school-house in all Bohemia. There are four great manufactories of woollen cloth, with fulling-mills and dyeing-houses. There are besides manufactories of stockings, hats, linen, and calico. The annual value of the goods manufactured here is above half a million sterling. The trade of the town is very considerable, it being the staple place for all woollen, linen, and cotton manufactures of the circle. The population is nearly 15,000.

On the 21st of April, 1757, a victory was gained near this town by the Prussians under the duke of Brunswick-Bevern, over the Austrians.

REICHENHALL, a town in the circle of the Isar in Bavaria, is situated in a romantic country on the left bank of the Saale, at an elevation of 1323 feet above the level of the sea. Though it has not 3000 inhabitants, it is a place of great importance, as being the central point of the four great salt-works of Bavaria, which are connected by an immense system of pipes and conduits, by which Traunstein and Rosenheim are provided with brine from this place, and the brine of the salt-springs at Berchtesgaden is brought to Reichenhall, either to be boiled with the brine of the springs there, or conveyed to Traunstein or Rosenheim. Almost all the manufactures of machinery, which furnish everything requisite for the salt-works, are at Reichenhall. The most antient documents relative to the salt-springs at Reichenhall are of the eighth century. As the great consumption of wood for so many years made fuel too scarce to boil all the brine on the spot, a very ingenious system of pipes was contrived in 1618 from Reichenhall to Traunstein, over an elevation of 828 feet perpendicular height, and extending eight leagues in length. A similar conduit to Rosenheim on the Inn, where there is abundance of wood, was made in 1809, by M. Reichenbach. It is fourteen leagues in length; so that now all the springs which formerly ran to waste for want of wood are turned to account. In 1817, M. Reichenbach, with very great skill, connected the salt-springs of Reichenhall, Traunstein, and Rosenheim with the salt-mines of Berchtesgaden. Though the Ferdinandsberg at Berchtesgaden is only 160 feet higher than Reichenhall, yet, on account of the intervening mountain-chain between the two places, it was necessary to raise the brine by waterworks to the height of 1579 feet, and so let it have a fall of 1740 feet to Reichenhall. For this purpose a conduit, partly covered, partly open, of 102,000 feet in length, part iron, part wood, was required. The machine erected at Illsang on a new principle by M. Reichenbach, raises the saturated brine to an elevation of 1218 feet perpendicular. The quantity of salt produced annually is 16,000 tons.

(Hassel; Stein; *Conversations Lexicon*.)

REID, DR. THOMAS, was born April 26th, 1710, at Strachan in Kincardineshire, about twenty miles from Aberdeen, of which parish his father, the Rev. Lewis Reid, was minister for fifty years. He was first sent to the parish school of Kincardine, and after two years he was removed to Aberdeen to be placed under a course of preparation for the university. At the age of twelve or thirteen he entered the Marischal College of Aberdeen. The principles of the philosophy of which he afterwards became so able an advocate he imbibed here under Dr. George Turnbull, author of 'The Principles of Moral Philosophy.' He continued beyond the usual time at the university, of which he had been appointed librarian. This office he resigned in 1736, and he then visited England in company with Dr. John Stewart, afterwards professor of mathematics in the Marischal College. They proceeded to London, Oxford, and Cambridge, and were introduced to several distinguished men, among whom were Dr. Bentley and Mr. Saunderson, the blind mathematician. In 1737 Reid returned to Scotland, and was presented by King's College, Aberdeen, to the living of New Machar in Aberdeenshire. His entrance upon this living was by no means a pleasant one. The parishioners, having been accustomed to a minister of intemperate zeal, and being averse to the system of patronage which led to this appointment, were at first violently opposed to Reid; but his unwearied attention to his duties and the mildness of his temper soon overcame their opposition, and converted their dislike into the highest esteem. It appears however that he had been so little used to composition, and was naturally so diffident, that for some time he delivered very few of his own sermons, but used those of Archbishop Tillotson and Dr. Evans. In 1740 he married Elizabeth, daughter of his uncle Dr. George Reid, a physician in London.

While he was minister of New Machar, he pursued a course of intense study; and in 1748 he inserted in the 'Transactions of the Royal Society of London' 'An Essay on Quantity, occasioned by a treatise in which simple and compound ratios are applied to virtue and merit.' In other words, it was an essay on the application of mathematics to morals. Doctors Pitcairne and Cheyne had recently attempted to apply mathematics to medicine, and Hutcheson to morals. According to the latter, the good done by a man depends partly on his benevolence and partly on his dispositions; the relations between these moral notions might be expressed algebraically, after this manner:—the benevolence or moral desert of an agent was analogous to a fraction, which had the good performed for the numerator, and the dispositions of the agent for the denominator. Reid, after examining in his essay the nature of mathematical proof, and the subjects to which it had been applied by Hutcheson, clearly showed that mathematics could by no means have a necessary relation to morals, because the truths to which the two sciences respectively refer addressed themselves to different faculties of the mind. In 1752 the professors of King's College, Aberdeen, elected Reid to be their professor of moral philosophy, in testimony of the high opinion which they entertained of his talents. After this appointment he devised the plan of a private literary society, which was soon formed, and which existed a long time. This society met once a week, and its object was the discussion of philosophical subjects for the mutual improvement of the members, among whom were Doctors George Gregory, Campbell, Beattie, and Gerard, including of course the projector. Though Reid had as yet published nothing but the 'Essay' mentioned above, his character as a philosopher was established; and in 1763 the university of Glasgow invited him to the chair of moral philosophy there, which was then vacant by the resignation of Dr. Adam Smith. He accepted this invitation, and entered upon his duties in 1764, in the discharge of which he laboured indefatigably to carry out his principles. In the same year he published his 'Inquiry into the Human Mind,' the substance of which he had previously delivered to his pupils at Aberdeen, and also read to the society just named. The principal object of this work was to counteract the influence of that scepticism which Hume had founded on the spiritual and ideal system of Berkeley. About the time that the 'Inquiry' was published, the author received the degree of D.D. from the university of Aberdeen. In 1773 he published, in Lord Kames's 'Sketches of the History of Man,' 'An Analysis of Aristotle's Logic,' which he wrote at the particular request of Lord Kames, who thought that no man was better acquainted with Aristotle's writings than Dr. Reid. In 1781 Dr. Reid withdrew from public labours; but he did not cease to pursue his favourite occupations. In 1785 he published his 'Essays on the Intellectual Powers,' of which the substance had been delivered, as he tells us, annually for more than twenty years to a large body of the more advanced students at Glasgow, and for several years before at Aberdeen. In 1788 came out his 'Essays on the Active Powers of the Human Mind.' Dr. Reid does not appear to have published any more works than those already mentioned; but he gave his attention to various other subjects, both in his private studies and in relation to his college lectures. Upon commencing his duties at Glasgow, he divided his course into four parts, after the example of his predecessor, Adam Smith: the first part comprised metaphysics; the second, moral philosophy; the third, natural law; and the fourth, political rights. He also gave lectures on rhetoric. He read several essays at different times before a philosophical society of which he was a member. Among these were 'An Examination of Dr. Priestley's opinion concerning Matter and Mind;' 'Observations on the Utopia of Sir Thomas More;' 'Physiological Reflections on Muscular Motion.' The last essay was read by Dr. Reid to his associates a few months only before his death, which took place October 7, 1796, in the eighty-seventh year of his age. After his death, his 'Essays on the Intellectual and Active Powers' were published by Mr. Dugald Stewart, as 'The Philosophy of Dr. Reid,' with a life of the author prefixed, from which this account of him it chiefly taken.

The moral and social qualities of Dr. Reid were such as naturally to inspire esteem, and in private life no man could be more highly esteemed than he was. As a writer, his language is simple and manly, and his style clear and forcible, without any pretence to ornament. Opinions vary as to the merits of his philosophy. His aim was to arrive at the general laws which regulate our mental operations by the inductive method, which, he thought, had never been applied to this subject. He has the merit of showing the unsatisfactory nature of certain moral systems proposed by his predecessors. Whether he has laid the foundation of a system that will prove satisfactory is very doubtful. Perhaps the laws which regulate the material world will never be found altogether applicable to the operations of mind. In all the attempts that have hitherto been made so to apply these laws, some conclusions have inevitably followed, which our sense of right and wrong refuses to admit, and this men will ever regard as a safer guide than any scheme of philosophy however ably propounded. As to Dr. Reid's view of Aristotle's logic, it appears only just to say that he did not clearly understand it. If candour and patient investigation could alone have unfolded the meaning of Aristotle, Dr. Reid would have been successful in this matter; but it is probable that he never received a good classical training, and never read Aristotle in the original with a mind free from the influence of the false interpretations of his writings which had so long prevailed. It is not to be expected that any man can understand Aristotle without thoroughly studying him in his own language.

(Stewart's *Life of Reid*; Chalmers's *Biographical Dictionary*; *Biographie Universelle*.)

REIGATE. [SURREY.]

REIMARUS, HERMANN SAMUEL, was born at Hamburg, December 22, 1694. Early in life he devoted himself to the study of languages, and he became distinguished for his knowledge of the Latin, Greek, and Hebrew. He pursued his studies at the university of Wittenberg, and upon the completion of his course, in 1717, he maintained some theses 'On the Differences of Hebrew Words,' which established his character for learning and acuteness. He then began to travel, and, having passed over several parts of Germany, he stayed a considerable time at Weimar, where he took the opportunity of publishing a collection of minor productions. After having satisfied his curiosity, he returned to Hamburg, and in 1727 he was made professor of philosophy in the university of that city, and he filled this office with much honour to himself during the space of 41 years. Reimarus married, in 1728, Johanna Frederica, the third daughter of the celebrated J. A. Fabricius. This connection with Fabricius proved to him the occasion of many and great advantages, and he also assisted Fabricius in some of his important literary labours. Towards the end of his life Reimarus devoted his hours of leisure to the study of natural history, of which he acquired an extensive knowledge. He had naturally a feeble constitution, and he was long a sufferer from ill health. He died March 1, 1768, in the 74th year of his age. Reimarus was a member of the Imperial Academy of St. Petersburg, and also of most of the literary societies in Germany. He was a man of varied and solid learning, of unwearied industry, and of great moral worth. His principal works are the following:—1, 'A Commentary on the Life and Writings of John Albert Fabricius,' Hamburg, 1737, 8vo.; 2, 'A Letter to Cardinal Quirini concerning the works of Dion Cassius,' Hamburg, 1746, 4to.; 3, 'The Roman History of Dion Cassius,' Hamburg, 1750, 2 vols. folio. In the publication of this work he availed himself of materials which had been prepared by his father-in-law, Fabricius, who had projected an edition of this author. Reimarus's edition of Dion Cassius is pronounced by Dr. Harwood 'one of the most correct and valuable Greek books ever published. 'The notes,' he adds, 'contain a treasure of erudition.' 4, 'A Dissertation on the Counsellors of the Great Sanhedrin,' Hamburg, 1751, 4to.; 5, 'A Discourse on the Principal Truths of Natural Religion,' Hamburg, 1754, 8vo.; 6, 'Observations, Physical and Moral, on the Instinct of Animals,' Hamburg, 1760, 2 vols. 12mo. He is said moreover to have written the essays which were published by Lessing, in 1774 and 1777, and known by the name of the 'Wolfenbüttel Fragments.' [RATIONALISM.]

(Weiss, in *Biographie Universelle*; Reimarus's *Life of J. A. Fabricius*.)

REIMS, or RHEIMS, a town in France, in the department of Marne, on the right or north bank of the Vêle, a feeder of the Aisne, 80 miles from Paris in a direct line east by north, or 96 miles by the road through Dammartin and Soissons, in 49° 14′ N. lat. and 4° 2′ E. long. In the Roman writers this town appears under the name of Durocortorum. It is mentioned by Cæsar, in whose time it was the capital of the Remi, one of the most considerable nations of Belgic Gaul, remarkable for their steady adherence to the alliance of Rome. Strabo writes the name Δουρικόρτορα (Duricortora). It was at the convergence of several military roads, according to the Antonine Itinerary and the Peutinger Table. At a later period it took the name of the people to whom it belonged, and is mentioned by this name (Remi) in Ammianus Marcellinus and in the Notitia. Under the Roman sway Durocortorum was the most important place in the province of Belgica Secunda; and was distinguished by its literary character. Cornelius Fronto, a rhetorician of the time of Hadrian, has compared it to Athens, an indication, making allowance for rhetorical exaggeration, of its reputation.

In 494 this city, then in the hands of the Franks, by whom it had been occupied after the defeat of Syagrius, was the scene of the baptism of Clovis and the chief lords of his court, after his victory at Tolbiac. In the civil troubles of the ninth and tenth centuries, Reims was repeatedly besieged, and twice at least taken and plundered. In 1179 it was signalized by the consecration of Philippe Auguste; all the succeeding kings of France down to Charles X. inclusive have also been consecrated here, with the exception of Henri IV. (who was consecrated at Chartres), Napoleon (who was consecrated at Paris), and Louis XVIII. (who was never consecrated at all). On the Revolution of 1830 the ceremony was abolished. Reims had become at an early period the seat of a bishop, who attained the rank of metropolitan of Belgic Gaul. In the middle ages several councils were held here. Reims was also the capital of a county, afterwards of a duchy. In 1359 it was blockaded for seven months by the English under Edward III., just previous to the treaty of Bretigny. In the campaign of 1814 it was taken (12th of March) by a corps of Russians, commanded by St. Priest, a French emigrant, and retaken next day by Napoleon, who killed 2000 of the enemy, with their commander.

The town is situated in a vast basin surrounded by chalk-hills, on which some good wines are produced. The site of the town is an oblong, extending from north-west to south-east. The antient walls which surround it are between two and three miles in extent; they are strengthened with towers, and, being planted with trees, form in summer a very agreeable public walk. They enclose within their circuit many large gardens and several spaces entirely unoccupied.

The entrance into the town is by six gates, called the gates of Mars, Ceres, Bacchus, Le Dieu Lumière or Dilimire, or Dieu Merite, Vêle or Paris, and the New Gate. There are suburbs to the gates of Ceres and Vêle. The gates of Ceres and Bacchus are supposed to indicate the sites of heathen temples which were without the walls of the Roman Durocortorum. The gate of Mars, a comparatively modern erection, has superseded a more antient one, disused since 1545, but still standing, and forming part of the circuit of the walls. It is a Roman triumphal arch of uncertain date. It has three arches; that in the centre about sixteen feet wide, those on the sides twelve or thirteen feet: all three covered with bas-reliefs, parts of which are too much defaced to be intelligible. This triumphal arch is also adorned with eight fluted Corinthian columns, of which only three are in good preservation. The gradual elevation of the soil has half buried this monument of antiquity.

The streets are wide and tolerably well laid out; they are well paved and neat, but present a dull appearance from the absence of bustle, and the grass which grows plentifully in them. The houses are for the most part built of chalk, or of boards covered with slate; some of them still present their gables to the street; and in others the upper stories project, and, being supported on wooden columns, form on the ground-floor a covered walk or gallery. The houses consist for the most part only of one story above the ground-floor. The squares are generally small and of irregular shape, except La Place Royale, a regular square, surrounded by good houses or public buildings of mingled Doric and Italian architecture, and having in its centre a well-executed statue of Louis XV. The streets are adorned with fountains supplied with water from the Vêle by the waterworks erected at his own cost by the Abbé Godinot, one of the canons of the cathedral. There is a pleasant public walk planted with trees on the west side of the town.

The most striking public building is the cathedral of Nôtre Dame, considered to be one of the finest Gothic edifices in Europe. It was commenced in the thirteenth century on the site of a more antient church, which had been destroyed by fire. The length of the nave and choir is about 480 English feet, the breadth 99 English feet, interior dimension; the length of the transept (croisée) is 160 English feet, interior dimension; the height of the building is 117 English feet. The western or principal front is surmounted by two square towers rising to the height of 267 English feet, and adorned by three large doorways, loaded with a vast number of statues, bas-reliefs, and other ornaments, many of which are of exquisite workmanship. Over the principal doorway is a fine circular window or rose of stained glass. The shafts of the flying buttresses, surmounted with statues, the rose-windows over the side-doorways, and the Angel Tower, a remarkably light bell-tower rising 59 English feet above the roof of the church at the eastern end, surmounted by a ball, and by the statue of an angel from seven to eight feet high, are all worthy of attention. The interior of the church is also very striking from the vast extent of the nave, the splendid stained-glass windows, the pavement of the choir, inlaid with marble of various colours, the antient baptismal fonts, the organ, reputed to be one of the best in France, the painting of Christ washing his disciples' feet, one of the finest works of Poussin, and the antient Roman tomb of Jovinus (a citizen of Reims, who, A.D. 366, attained to the honour of the consulship, and died in 406), formed of a single block of white marble, adorned with sculptures in relief, of tolerably good workmanship.

The church of St. Remy, the most antient in the town, is almost as large as the cathedral, but not so lofty; the principal front is of simple architecture, surmounted by two lofty spires. The interior is remarkable chiefly for the tomb of St. Remy, bishop of Reims in the fifth century, an elaborate piece of workmanship, erected in 1803, partly from the remains of the more antient one destroyed in 1793. The sacred Ampulla (Ampoule), or vessel containing the oil with which the kings of France were anointed, and reputed to contain a portion of the very oil with which St. Remy had anointed Clovis, was deposited in this church until it was destroyed in the revolutionary troubles.

The church of St. Nicaise, demolished during the revolutionary period, was by many considered the finest church in the town; it was superior in elegance to the cathedral, though inferior to it in the richness of its ornaments. There are three other churches, a town-hall, and other buildings. The town-hall, begun in 1627, but not finished till 1825, is made up of three compartments, a centre and two wings, adorned with Doric, Ionic, and Corinthian columns. Over the central building, the architecture of which is superior to that of the wings, rises a tower, having a clock, an equestrian statue of Louis XIII., and four pedestrian statues. The public library is deposited in the town-hall.

The population of Reims was estimated by Expilly to have been, at the close of the seventeenth century, 30,000; and in the middle of the eighteenth, about 27,000. At the commencement of the present century it had risen again to 30,000; in 1826 it was 34,862; in 1831, 35,971; and in 1836, 38,359. The manufactures are extensive, chiefly of woollens, or fabrics of wool combined with other materials, in which branch of industry, in and round the town, 15,000 persons are employed by about 180 master-manufacturers. It is estimated that 1,200,000 kilogrammes (about 24,000 cwt.) of wool are consumed; the yearly value of the productions of the town is estimated at above a million sterling; they include woollen cloths, kerseymeres, light stuffs for summer coats and trowsers, swanskins, camlets, merinos, Cashmere shawls, flannels, blankets, carpets, hosiery, &c. The yarn is spun partly by steam-power, partly by water, and partly by horse-power. There are also manufactures of bolting-cloth, cordage, candles, soft soap, and leather. Wax and woollen bleaching, dyeing, wool-combing, brewing, and the making of machinery, are carried on. The spiced bread and biscuits of the town are in great repute. The chief trade is in the above-named articles of manufacture, corn, flour, Champagne wines, brandy, spices, colonial produce, wool, cotton-yarn, flax, hemp, raw hides. There are four yearly fairs. The trade of the place is restricted by the want of water-carriage; there are however good roads to Paris, Châlons-sur-Marne, Mézières, St. Quentin, and other places.

The woollen manufacture of Reims owes its origin to the great minister Colbert, who was a native of the town.

Reims is the seat of an archbishopric; it has an assize court, a subordinate court of justice, a commercial tribunal, and a chamber of manufactures, arts, and trades; several fiscal government offices, a public library of 25,000 volumes and 1000 manuscripts, a high school, a secondary school of medicine, schools on the principle of mutual instruction (*i. e.* Lancasterian schools), a botanic garden, at which courses of instruction are given, a savings' bank (*caisse d'épargne*), a loan-office (*mont de piété*), and other institutions. There are two seminaries for the priesthood, and some nunneries; before the Revolution the town was remarkable for the number of its monastic establishments. There are four hospitals or asylums, including one for orphans. The principal hospital, the Hôtel Dieu, occupies the buildings formerly belonging to the abbey of St. Remy, in which is some carved wood-work of great delicacy. There are two establishments of baths, and a large and convenient theatre.

Among the eminent natives of Reims are Colbert, the Abbé Pluche, and Linguet, a man of letters, who perished during the Revolution.

The diocese of Reims was of early foundation; it was at first a simple bishopric, and comprehended the territory subsequently assigned to the dioceses of Laon and Châlons. St. Remy occupied the see in the time of Clovis, whom he baptised. In the eighth century the bishopric was elevated to the rank of an archbishopric: its occupiers possessed great influence, and Hincmar, who held it in the middle of the ninth century, was one of the leading personages of his time.

The archbishops claimed, and in most cases exercised, the right of officiating at the consecration of the kings of France; they had the dignity of dukes, and ranked first among the peers of France. The suffragans of the see were antiently the twelve bishops of Amiens, Arras, Beauvais, Boulogne, Cambray, Châlons, Laon, Noyon, Senlis, Soissons, Therouenne, and Tournay; but four of these were withdrawn on the elevation of Cambray (in A.D. 1559 and 1560) into an archbishopric, with Arras, Therouenne, and Tournay as its suffragans; and others were suppressed at the Revolution. At present the suffragans are the bishops of Amiens, Beauvais, Châlons, and Soissons. The diocese of Reims comprehends the town and its arrondissement.

The arrondissement of Reims has an area of 685 square miles; it comprehends 181 communes, and is divided into ten cantons. The population, in 1826, was 118,340; in 1831, 120,680; and in 1836, 123,919.

REINEKE or REINEKE FUCHS, Reynard the Fox (Reineke is probably only a corrupt diminutive of Reynard, or the French *Renard*), is a poem which, during the latter part of the middle ages and the early centuries of modern times, had an almost European reputation, for in some form or other it was known and read all over Europe.

The first complete version of the story in German verse was printed in 1498 at Lübeck, and bears the title 'Reynke de Voss.' It is written in the Frisian dialect, which is only a modification of that spoken in Lower Saxony, and it consists of four books, each of which is subdivided into chapters. The verses consist of iambics mixed with numerous spondees and anapæsts. The poem contains a lively picture of a court, in which the prince allows himself to be guided by the flattery of a deceitful and cunning favourite, who, notwithstanding all the wrongs that he inflicts upon others, is still successful to the last. The moral conveyed is this, that in the affairs of this world cunning has the advantage over justice. The king and his vassals and officers, as well as all other classes of persons, are represented, as in the fables of Æsop, under the names of such animals as are most suited to their individual characters. The king is accordingly represented under the name of Lion; his friend and favourite is the fox (Reineke), who, after having silenced, by his cunning, his hypocrisy, and lies, the charges which are brought against him by other animals, is loaded with favours and marks of honour by the king and his queen, and, accompanied by a numerous train of friends, returns to his castle Malepartus, where he relates to his family the happy issue of his dealings at court. The whole poem is a satire, but written in a truly epic style. The great number of editions which appeared in Germany after the first publication of it, and still more the numerous bad paraphrases in prose, which were sold by thousands at every fair, show the immense popularity which the story had in Germany.

The first edition is preceded by a prose introduction, in which the author of the German version calls himself Hinrek von Alkmer, and states that he translated the story from the Welsh (French) into German verse. But as no trace of this Alkmer can be found, the statement of Rollenhagen, who, in the preface to his 'Froschmaüsler,' calls Nicolas Baumann the author of 'Reynke de Voss,' has generally been adopted, though nothing certain is known of the matter. (Flögel, *Gesch. d. Komisch. Lit.*, iii., p. 28, &c.) The last and best edition of the poem was edited by Hoffmann von Fallersleben (Breslau, 1834), with an introduction, glossary, and commentary. The text is a correct reprint of the first edition. Göthe has made a most beautiful translation of 'Reineke Fuchs' into modern High-German, in hexameters (Berlin, 1794); D. W. Soltau has made another, in doggrel-verse (Berlin, 1803), a new and much improved edition of which appeared at Braunschweig, 1823. It has also been translated into Latin by Hartmann Schopper, under the title 'Opus poeticum de admirabili fallacia et astutia vulpeculæ Reinikes,' &c., Frankfort, 1574; this translation has often been reprinted. In 1706 there appeared in London a metrical English translation from the Latin of Schopper.

The German version of Reineke was, notwithstanding the statement of its author, formerly thought to be an original composition, but the subject was known for many centuries and in several countries before the German poem was printed. A Dutch edition of the story of Reineke, in prose, interspersed with occasional verses, was printed, in 1485, at Delft; it was reprinted in 1783, at Lübeck and Leipzig, under the title 'Die Historie va Reinaert de Vos.' The author of this Dutch version, which is in many respects superior to the German, and has probably served as the source from which the German poet drew his materials, calls himself Willam Matok, and also refers to a French work which had served him as his model. But even this Dutch version cannot have been the first, for Caxton (1481), in his English translation, states that he kept closely to a Dutch original. It may be inferred, from the various subsequent corrected and enlarged editions of this poem, as well as from the allusions of our early dramatists, that it gained considerable popularity in England also. The Flemish likewise possess an excellent metrical version, which was published in 1836, at Ghent, by Willems, with a very valuable introduction. The early French literature however is the richest in poems founded on the story of Reynard. Méon, in his 'Roman du Renard' (Paris, 1826), has shown that most of these poems belong to the thirteenth century, and more modern researches have proved that the story was known as early as the ninth century. The subject is one which so readily presents itself to the imagination, that it would be impossible with any probability to assign its invention to any particular time or nation. Whenever a work of fiction of commanding interest appears, unpoetical minds are always ready to seek some real history disguised under it, and this has been the case with this poem ever since its publication, until Jacob Grimm, in his 'Reinhart Fuchs' (Berlin, 1834), showed that there is no ground whatever for such a supposition. (Compare Carlyle's *Miscellanies*, vol. iii., p. 197, &c.)

REINE'SIUS, THOMAS, one of the most learned of modern physicians, was born at Gotha in Saxony, on the 13th of December, 1587. He was tolerably versed in the Greek and Latin languages at the age of twelve; and being afterwards sent to Wittemberg, the professors wished him to apply to theology. His inclination however led him to medicine: he continued his studies at Jena, and then travelled through various parts of Germany and Italy, remaining some time at Padua, for the sake of the medical lectures delivered there. On his return through Basle, he took his degree of doctor of medicine in that university, and then passed some time at Altdorf, in the hope of procuring a professorship by the interest of his relation Caspar Hoffman. He married, and, in 1617, settled in the practice of his profession at Hof in Franconia. Thence, on the invitation of the margrave of Bareith, he removed to that town, having the posts of the margrave's physician and inspector of the public schools. In 1627 he accepted the place of public physician of the town of Altenburg, in which he resided several years, and obtained the dignity of burgomaster. The elector of Saxony conferring upon him the rank of counsellor, he finally removed to Leipzig, where he died in 1667, at the age of eighty. Reinesius was a man of vast erudition, and may be reckoned almost at the head of learned physicians. 'There is scarcely anything (says Saxius) in the Greek and Latin authors, especially the antient medical writers, or in the monuments of antiquity, which he has left untouched in his epistles, observations, various readings, scholia, or disputations, either published or in manuscript.'

Bayle says of his writings in general, that 'good judges of literature have no sooner read some pages, but they place him above those philologers who have only a good memory, and rank him with critics who go beyond their reading, and know more than books have taught them. The penetration of their understanding enables them to draw consequences, and suggests conjectures which lead them to the discovery of hidden treasures. They by this means dart a light into the gloomy places of literature, and extend the limits of antient knowledge. Reinesius was one of this class of critics, and made it his chief business to find out what others had not said.' By his printed letters it would appear that he was consulted as an oracle; that he answered very learnedly whatever questions were brought to him; and that he was extremely skilled in the families of antient Rome, and in the study of inscriptions. A great eulogium is given of his merit, as well as of his learned and classical works, by Grævius, in the dedication of the second edition of Casaubon's Epistles, dated Amsterdam, August 31, 1655; and by Haller, who calls him (*Biblioth. Medic. Pract.*) 'a miracle of learning' (*ad miraculum doctus*); and says that 'in the accurate study and comparison of antient writers, and in sagacity in discovering the true reading of corrupt passages, he was unrivalled.' He partook of the liberality which Louis XIV. showed to the most celebrated scholars of Europe, and received at the same time a very obliging letter from Colbert, which favour he returned by dedicating to him one of his works. With respect to the character of Reinesius, his religion was suspected to be of the philosophical kind, and he seems to have no small share of the pride and irritability that too often accompany the possession of great talents and learning. This involved him in several angry controversies, and is said to have been the cause of his leaving Altenburg. He had a quarrel upon a ludicrous occasion with his friend Caspar Barthius, who, upon paying a visit to him when burgomaster, was taken by his beadle for the common hangman, and refused admission to his master. In spite of his numerous occupations and the duties of his office, he kept up a correspondence with several of the most eminent literary characters of his age, and several valuable collections of his letters have been published, viz. those to Caspar Hoffmann and Christ. Ad. Rupert, Leipzig, 1660, 4to.; to John Vorstius, Cologne, 1667, 4to.; to the elder and younger Nester, Leipzig, 1670, 4to.; to Christopher Daum, Jena, 1670, 4to.; and to John Andrew Bose, Jena, 1700, 12mo. Besides some notes on Manilius, inserted in the Strasburg edition, 1655, 4to., and some observations on Petronius, Leipzig, 1666, 8vo., one may mention the following works of Reinesius:—1, 'De Diis Syris, sive de Numinibus Commentitiis in Veteri Testamento Memoratis Syntagma,' Lips., 1623, 4to. This work, though learned, is less complete than that which Selden published afterwards on the same subject. 2, 'De Deo Endovellico ex Inscriptionibus in Villa Vizosa Lusitaniæ repertis Commentatio Parergica,' Altenb., 1637, 4to. This is a divinity of the antient Lusitanians, the same as Mars, or, according to others, Love 3, ''Ἱστορούμενα Linguæ

Punicæ Errori populari, Arabicam et Punicam esse eandem, opposita,' ibid., 1637, 4to. This curious dissertation has been inserted, as well as the preceding one, by Grævius, in the 'Syntagma Variar. Dissertat. Rariorum,' Ultraj., 1702, 4to. 4, 'Variarum Lectionum Libri Tres Priores, in quibus de Scriptoribus sacris et profanis, classicis plerisque, disseritur,' ibid., 1640, 4to. These three first books were to have been followed by three others, which never appeared. It is a thick volume of about seven hundred pages, of multifarious and (as Haller says) incredible learning, chiefly, but not exclusively, classical. It also contains a good deal of matter relating to medicine, and explains several obscure and difficult passages in the antient physicians and those of the middle ages. Some of the explanations of Reinesius were attacked with much bitterness by André Rivinus, who was not ashamed of making use afterwards of all sorts of means to prevent his adversary from answering him, and even wished the magistrates to take part in a discussion entirely literary. Reinesius however succeeded in thwarting these intrigues, and published his reply under the title of 'Defensio Variarum Lectionum contra Censuram Poëtae L. (*Laureati*),' Rostoch., 1653, 4to. 5, 'Inscriptio vetus Augustæ Vindelicor. eruta et Commentario illustrata,' Lips., 1655, 4to. 6, 'Ænigmati Patavino Œdipus è Germaniâ, hoc est Marmoris Patavini Interpretatio,' ibid., 1662, 4to. This is a new explanation of the famous epitaph of Ælia Lælia Crispis, which has so much and so uselessly occupied some learned men. 7, 'De Palatio Lateranensi ejusque Comitivâ Commentatio Parergica, accedit Georg. Schubarti, de Comitibus Palatinis Cæsareis Exercitatio historica,' Jenæ, 1679, 4to. 8, 'Syntagma Inscriptionum Antiquarum,' Lips., 1682, fol. This collection only contains the inscriptions omitted, or badly explained, by Gruter. It was regretted by the learned that the editor should not have published at the same time another work of Reinesius (*Eponymologium Criticum*), which could not fail to explain a number of obscure passages in the Latin and Greek authors. The original manuscript was, in 1717, in the hands of Th. Fritsch, a bookseller at Leipzig; and it was thought that he would comply with the wishes of all philologers by having it printed (Klefeker, *Biblioth. Eruditor. Præcocium*, p. 313); but these hopes have not been realised. 9, 'Dissertatio critica de Sibyllinis Oraculis,' Jena, 1702, 4to., at the end of a work by George Schubart, 'Enarratio Parergica Metamorphoseos Ovidianæ de Diluvio Deucalionis.' 10, 'Judicium de Collectione MSS. Chemicorum Græcorum quæ extant in Biblioth. Gothanâ,' inserted in the 'Catal. Cod. MSS. Biblioth. Gothanæ,' Lips., 1714, 4to., p. 88; and in the 'Biblioth. Græca' of Fabricius, vol. xii., p. 748. To these works, which are mentioned in the 'Biographie Universelle,' and Klefeker (loco cit.), may be added, from Bayle.—11, 'De Vasis Umbilicalibus, eorumque Ruptura Observatio Singularis,' Lips., 1624, 4to. 12, 'Chymiatria, hoc est Medicina Nobili et Necessaria sui Parte, Chymia, instructa et exornata,' Geræ-Ruth., 1624, 4to. C. G. Müller lately edited his 'Observationes in Suidam,' 8vo., Lips., 1819. Another work appeared under his name, which was in fact the production of Fortunatus Fidelis, entitled 'Schola Jurisconsultorum Medica, Relationum aliquot Libris comprehensa, quibus Principia Medicinæ in Jus transumpta ex professo examinantur,' Lips., 1676, 8vo. Several other works have also been wrongly attributed to him. Some letters of Reinesius are to be found at the end of his eulogium, in the 'Elogia Clarorum Altenburgensium,' by Fred. Gotth. Gotter, Jena, 1713, 8vo. Bayle, in his 'Dictionnaire,' and Niceron, in vol. xxx. of his 'Memoirs,' have given an interesting account of him. His Life, written by himself in German, and found among his manuscripts, has been made use of in the account given by Witten, 'Memor. Philosoph.,' dec. viii., p. 461, &c. J. Brucker has inserted a more detailed life, in German, in his 'Ehrentempel der deutscher Gelehrsamkeit,' dec. iii., p. 110, Augsburg, 1747, 4to.

REINDEER. [DEER, vol. viii., p. 354.]

REINHOLD, ERASMUS, was born October 21, 1511, at Saalfeld, about sixty miles south-west from Leipzig. He taught astronomy and mathematics in the university of Wittenberg till the year 1552, when, being obliged to quit that city on account of the plague, he returned to his native province of Thüringen, where he died February 19, 1553. His published works are:—1, 'Commentary on the Theoricæ novæ Planetarum G. Purbachii,' 1542 and 1558, 8vo. 'This work,' observes Delambre, 'supplied in some respect the omissions of Purbach, and must have facilitated the understanding of several passages of the Syntaxis of Ptolemy. In the dedication Reinhold shows himself so infatuated with judicial astrology as to be at the trouble of collecting all the instances which appeared confirmatory of the notion that solar eclipses were the harbingers of great calamities. 2, The first book of the Almagest, in Greek, with a Latin version and scholia, 1549, 8vo. 3, 'Prutenicæ Tabulæ Cœlestium Motuum,' 1551, 1571, and 1585, 4to. These tables were formed from the observations of Copernicus, compared with those of Hipparchus and Ptolemy. Reinhold had made some observations himself, but his best instrument was a wooden quadrant, and Tycho, on visiting Wittenberg in 1575, expressed his surprise that so celebrated an astronomer should have been provided with no better tools. In this work the author gives a very clear explanation of the equation of time. He assigns three reasons to account for astronomical tables, constructed at one period, not according with more recent observations, namely, the motion of the apogee, the variation of the excentricity, and the inequality of the precession. The last was sensible only in the systems of Thébith and Copernicus. The excentricity of the sun he makes from 0·0417 to 0·03219, and the mean precession $50'' 12''' 5'''' 8'''''$. From a comparison of the observations of Ptolemy and Copernicus, he makes the length of the year 365d. 5h. 55m. 58s., and this determination was employed in the Gregorian reformation of the calendar. He computes the motion of the planets both after the manner of Ptolemy and that of Copernicus, whence Bailly concludes that he had no decided preference for either system. 'This conclusion,' observes Delambre, 'appears to me hazarded. The most that can be inferred is that the partisans of the antient system were yet the more numerous, and that Reinhold sought to conciliate all parties. He says nothing which can lead the reader to suspect the existence of two different systems. He neither speaks of the motion of the earth nor of that of the sun. His tables resemble our own, which still give the motions of the sun, notwithstanding that we are all Copernicans. It cannot be supposed that he who wrote a commentary on the work "De Revolutionibus," &c., who repeated all the calculations and reconstructed the tables of Copernicus, had not a sentiment of preference for a system which he had studied more than any one of his day.' The Prutenic tables were the result of seven years' labour, and where so called, in compliment to the author's benefactor, Albert, marquis of Brandenburg and duke of Prussia. The 'privilege,' printed at the head of the work, which bears the date July 24, 1549, refers to several other compositions which the author contemplated publishing, such as ephemerides, tables of the rising and setting of the stars for various epochs and latitudes, &c. 4, 'Primus Liber Tabularum Directionum, discentibus prima elementa Astronomiæ, necessarius et utilissimus. His insertus est Canon Fæcundus ad singula scrupula quadrantis propagatus. Item nova Tabula Climatum et Parallelorum, item Umbrarum. Appendix Canonum secundi libri Directionum qui in Regiomontani Opere desiderantur,' Tübingen, 1554, 4to. In this work the table of tangents was first extended to each minute of the quadrant from 0° to 89°, and to every $10''$ from 89° to 90°. The last figure of the tangents here given can nowhere be depended on, and above 70° the error is much greater. Like Müller, he showed himself very little acquainted with the use to which such a table is applicable, notwithstanding the epithet 'fæcundus' which they applied to it. Reinhold supposed, with Copernicus, that the obliquity of the ecliptic varied from 23° 28′ to 23° 52′. 5, 'Tabulæ Ascensionum Obliquarum à 60° Gradu Elevationis Poli usque ad Finem Quadrantis, per Erasmum Reinholdum supputatæ,' appended to the edition of Müller's 'Tables of Directions,' printed in 1584. 6, There is also an anonymous work, printed in 1568, 8vo., entitled 'Hypotyposes Orbium Cælestium quas vulgo vocant Theoricas Planetarum Congruentes cum Tabulis Astronomicis,' which is supposed to be the composition of Reinhold. See *Astron. Moderne*, i., pp. 142 and 146.

(*Astronomie du Moyen Age*, pp. 272-4; *Astron. Moderne*, i., p. 164; Zedler, *Grosses Universal Lexicon*, Leip., 1742, fol., band 31, p. 206; Vossius, *De Scientiis Mathematicis*, c. 36, p. 14; Dappelmayer, *De Mathem.*, &c.)

REINHOLD, ERASMUS, son of the preceding. He possessed some knowledge of astronomy, and submitted to Tycho a copy of the Prutenic Tables calculated to each $10''$, but the want of fortune obliged him to adopt the medical profession.

REISKE, JOHANN JACOB, a physician, and celebrated scholar, whose fame rests chiefly on his knowledge of Arabic, was born on the 25th of December, 1716, at Zorbig, a small town near Leipzig. His grandfather was an innkeeper, and his father a tanner. At the age of twelve he was sent to the orphan-school at Halle, and was entered at the university of Leipzig in 1733, where, being destined by his relations to the theological profession, he spent five years chiefly in the study of the rabbinical writings and Arabic. He was soon induced to renounce the first of these pursuits, but he became extremely devoted to the second; and his passion for Arabic books was so strong that he almost deprived himself of the common necessaries of life in order to purchase them. The learned Wolf of Hamburg having, in 1736, sent him the 'Narrations' of Hariri, he copied it with great eagerness, and in the following year printed at Leipzig the twenty-sixth 'Consessus' with Arabic scholia and a Latin version. The success of this essay caused him to take the resolution, contrary to the advice of his friends, of going to Holland for improvement in the Arabic language. He ransacked all the Oriental treasures of the library at Leyden, whilst for his subsistence he was obliged to become a corrector of the press. He passed his time in a state of indigence and discountenance that brought upon him hypochondriac affections, the effects of which never left him. During his stay at Leyden, he made use of the advantages the place afforded for the study of medicine, and on his return to Leipzig he was presented with a gratuitous degree of doctor of physic; but his manners and habits were altogether unsuited for the obtaining of professional practice. Poverty was his perpetual companion, and his scanty resources were derived from correcting the press, translating, and performing other tasks for booksellers. His condition soured his temper; and he made many enemies by the severity of his censures. In the mean time, many valuable works in Oriental and Greek literature were occasionally proceeding from his pen, which made him well known to the learned world, and he was at length nominated rector of the college of St. Nicholas in Leipzig. Thus placed in happier circumstances as to fortune, he pursued his literary labours more according to his inclination, and fulfilled the duties of his office with exemplary diligence. At the age of forty-eight he married Ernestine Christine Müller, a young woman of twenty-nine, who was afterwards of great use to him in his editorial employments. He died on the 14th of August, 1774, at the age of 58.

The following is a list of some of the most valuable of his works, beginning with those on Oriental subjects:—1, 'Miscellaneæ aliquot Observationes Medicæ ex Arabum Monimentis,' 4to., Lugd. Bat., 1746, a little work of much importance to all who take an interest in the Arabic physicians, which was republished after Reiske's death by Christ. God. Grüner, 8vo., Halæ, 1776. 2, 'Abilfedæ Opus Geographicum.' This translation of the Geography of Abdulfeda is to be found in Büsching's 'Magazin für die neue Historie und Geographie,' vols. iv. and v., Lips. 1770, 8vo. Unfortunately Reiske did not possess sufficient mathematical knowledge to understand the systematic part of such a work. The whole of it has lately been published at Paris in Arabic, 4to., 1840, by MM. Reinaud and le Baron MacGuckin de Slane, and a French translation with notes and illustrations by M. Reinaud will shortly appear. 3, 'Proben der Arabischen Dichtkunst in verliebten und traurigen Gedichten, aus dem Motanabbi, Arabisch und Deutsch, nebst Anmerkungen,' Leipzig, 1765, 4to. This contains only a part of the poems of Motanabbi, the whole of which he had copied out during his residence at Leyden, and wished to publish. A German translation of the whole of his poems is among his unpublished manuscripts. 4, 'Abilfedæ Annales Moslemici,' Leipzig, 1754, 4to. This volume contains the translation of the Annals of Abulfeda [ABULFEDA] from the birth of Mohammed to A.H. 406 (A.D. 1015-6): it is scarcely two-fifths of that part of Abulfeda's work which treats of the history of the Mohammedans. Reiske did not translate the first part of this work, which has for its object the history of the time anterior to Mohammed. In his preface Reiske has mentioned all he has written upon Abulfeda, and the motives which induced him to publish successively and in parts his translation, notes, historical commentary, and the different indexes which were to facilitate the use of the work. He justly experienced great regret at not being able to publish the text, as he had hoped to do; and the sale of this volume was so much below what he had hoped, that he gave up all idea of printing the rest of the translation. Happily the public in the present day, through the generosity of M. de Suhm, are in possession of the Arabic text of this important work, which alone would have sufficed to assure to Reiske the gratitude of the learned world. It has been printed under the direction of M. Adler, under the title, 'Abulfedæ Annales Muslemici,' Arab et Lat., Hafniæ (*Copenhagen*), 5 vols. 4to., 1789-1794. The translation of Reiske often degenerates into a paraphrase, which does not prevent persons who are ignorant of the language of the original from making use of it with confidence; the historical notes which are joined to it add greatly to its value, and it is only to be regretted that M. Adler has not given a table of all the proper names that those annals contain. His other works consist of editions of various classical authors, as 'Constantinus Porphyrogennetus,' Gr. et Lat., fol., Lips., 1751, 1754; 'Ciceronis Tusculanæ Quæstiones,' 12mo., Lips., 1759; 'Theocritus,' Gr. et Lat., 4to., 2 vols., Lips., 1766; 'Oratores Græci,' Gr. et Lat., 8vo., 12 vols., Lips., 1770-75; 'Plutarchi Opera Omnia,' Gr. et Lat., 8vo., Lips., 1774-82, 12 vols., of which only the first appeared during his life; 'Maximus Tyrius,' Gr. et Lat., 8vo., 2 vols., Lips., 1774; 'Dionysius Halicarnassensis,' Gr. et Lat., 8vo., Lips., 1774-77, 6 vols., of which the four last were published after his death. Some of these latter works, as well as several translations, were hastily executed in order to gain a livelihood, and most of them have been superseded by more recent and accurate editions. A complete list both of his published works and his manuscripts is given by Reiske's wife, in her continuation of his memoirs, which were published at Leipzig, 1783, 8vo., under the title, 'J. J. Reiskens von ihm selbst aufgesetzte Lebensbeschreibung,' pp. 818. His knowledge of Greek was considerable, and he is universally allowed to have been one of the best Arabic scholars that ever lived; in both these languages however he is much too bold and hasty a critic to be implicitly trusted, and his alterations and conjectures are frequently unnecessary and absurd.

REISKE, ERNESTINE CHRISTINE, whose maiden name was Müller, the wife of the preceding, and a woman of great literary accomplishments: she was born on the 2nd of April, 1735, at Kumberg, a small town near Wittemberg in Prussian Saxony. In 1755 she became acquainted with Reiske at Leipzig, where she was paying a visit. Her beauty, modesty, goodness of heart, and fondness for literature, immediately attracted his notice; and notwithstanding that he was twenty years her senior, they conceived a mutual love and esteem for each other; owing however to the war which raged all over Saxony, they were not married till 1764. This union, which contributed so much to Reiske's happiness during the rest of his life, was also of service to the cause of literature, and Christine Reiske deservedly occupies a distinguished place in the list of learned women. In order to help her husband by dividing with him his literary labours, she acquired under his instructions such a knowledge of Latin and Greek that she was soon able to understand the writers in those languages. From this time she was of the greatest assistance to him: she copied and collated manuscripts for him, arranged the various readings that he had collected, and read and corrected the proof-sheets of his works. Her attachment for him and her respect for his memory are strongly shown in the supplement to his Autobiography, which she completed, from the first of January, 1770, to the time of his death in 1774. The gratitude of Reiske, and the ardour of his affection for one who lived only for him, are not less strongly expressed both in the autobiography just mentioned and in the prefaces to some of his works. On the occasion of his publishing his Demosthenes, we have the following interesting note by his wife in his Memoirs:—'When the work went to press, only twenty thalers of the subscription money had come in. The good man was quite struck down with this, and seemed to have thrown away all hope. His grief went to my soul, and I comforted him as well as I could, and persuaded him to sell my jewels, which he at length came into, after I had convinced him that a few shining stones were not necessary to my happiness.' After her husband's death she published several works that he had left unfinished: viz., the three last volumes of the 'Oratores Græci,' 8vo., Lips., 1775; 'Libanii Sophistæ Orationes et Declamationes,' Altemb., [illegible] 8vo.; [illegible] 'Dionis Chrysostomi Orationes,' Græce, [illegible] Lips., 1784. She also published two works herself, [illegible] at Mitau, 2 vols. 8vo., 1778, 1779, with the title of 'Hellas;' and another entitled 'Zur Moral; aus dem Griechischen übersetzt von E. C. Reiske,' pp. 384, 8vo., 1782, Dessau and Leipzig, containing several moral works translated by her from the Greek into German. Concerning this last work see the 'Bibliotheca Critica,' by Wyttenbach, part viii., page 142, Amstel. 1782. She also gave to Mr. Boden, for his edition of the Greek romance of Achilles Tatius (Leipzig, 1776, 8vo.), the various readings of a manuscript collated by herself. After her husband's death she lived successively at Leipzig, Dresden, and Brunswick, and died at her native town, Kumberg, of apoplexy, at the age of sixty-three, on the 27th of July, 1798

REJOINDER. [PLEADING.]

RELAND, ADRIAN, an eminent Orientalist and scholar, was born at Ryp, a village in North Holland, July 17, 1676. His father was a minister of that village, but afterwards removed to Amsterdam, where Reland was educated. He made such progress in learning, that at eleven years of age he had passed through the usual classical course. The next three years he spent in making himself acquainted with the Hebrew, Syriac, Chaldee, and Arabic languages, under the tuition of Surenhusius. At fourteen he was sent to Utrecht, where he studied under Grævius and Leusden; and, three years after, was admitted to the degree of doctor in philosophy, on which occasion he sustained a thesis, 'De Libertate Philosophandi.' At seventeen he entered upon a course of divinity, under the direction of Herman Witsius and others; but he did not abandon the Oriental languages, which were always his favourite studies. After a residence of six years at Utrecht, he removed to Leyden, and soon after the earl of Portland chose him as preceptor to his son. In 1699 he was elected professor of philosophy at Harderwick, but did not continue long in that situation; for the university of Utrecht, on the recommendation of King William, offered him the professorship of Oriental languages and ecclesiastical history, which he readily accepted, and filled with high reputation during the remainder of his life. In 1713 a Society for the Advancement of Christian Knowledge being established in England, Reland became a member of it, as well as of that for the Propagation of the Gospel in Foreign Parts, instituted the year after. He died of the small-pox at Utrecht, Feb. 5, 1718, in the forty-second year of his age. He wrote and published a great number of works on sacred and Oriental learning, the chief of which are the following:—'De Religione Mohammedica Libri Duo,' Utrecht, 1705, 12mo., a second edition of which, with many additions, was published at the same place, 1717, 12mo.; 'Dissertationum Miscellanearum Partes Tres,' 1706, 1707, 1708, 12mo. These three parts, which are not always found together, comprise thirteen dissertations upon various subjects, more or less connected with Eastern history and antiquities, with the exception only of one, treating of the languages of America. 'Analecta Rabbinica,' ib. 1702, 8vo.; 'Antiquitates Sacræ Veterum Hebræorum,' 1708, 12mo.; 'Dissertationes quinque de Nummis Veterum Hebræorum,' &c.; 'De Spoliis Templi Hyerosolymitani in arcu Titiano Romæ conspicuis,' 1716, 12mo.; 'Oratio pro Lingua Persica,' ib., 1701, 4to.; and a dissertation on the Marbles of Puteoli, ib., 1709, 12mo. But his greatest work, and that in which his learning of the Eastern languages shines most conspicuous, is 'Palæstina ex Monumentis Veteribus illustrata et Chartis Geographicis accuratioribus illustrata,' which appeared first at Utrecht, 1714, 2 vols. 4to., and was reprinted at Nürnberg, 1716, 4to. Besides the above works, Reland wrote many others, as the 'Dissertatio de Philippi Imperatoris Patris et Filii credito temere Christianismo,' a funeral oration to the memory of Mary, wife of William III. of England, a dissertation on the progress of philosophy at the beginning of the eighteenth century, &c.

RELATION (Mathematics). What we here mean by this word would have been explained in the article EQUATION, if we had confined ourselves to the explanation of arithmetical algebra; but having in the articles NEGATIVE, &c. QUANTITIES, and OPERATION, endeavoured to give higher views, we are induced to insert the present article by remembering that the difficulties of such a subject are of very different kinds to different persons, insomuch that any point of view may be usefully taken with reference to some minds, and any detail upon a fundamental notion may remove misapprehension in one quarter or another. There are some who ought to find great part of the present article an unnecessary appendage to the former two, and others who may perhaps find in it nothing but necessary explanation.

All reasoning is the discovery of relations which are not evident from those which are given, or rather, since the proposed result is sometimes evident in itself, reasoning is the establishment of one relation as a necessary consequence of others. The term relation would be difficult to define in a manner satisfactory to all; it is enough for our present purpose to say a relation exists between any two objects, whether of sense or intellect, whenever they have anything in common; that is to say, the common point, whatever it may be, may be made the means of referring one to the other, or bringing our thoughts from one to the other, so as to think of both at the same time, and to compare the two. All the manifold senses of the word may be derived from this one: the relationship of blood implies a common ancestry; the relationship of office, common duties. In mathematics the relation of greater, equal, or less, implies that one of the magnitudes is the same as to quantity with part or all of the other, and so on. Sameness in every respect would constitute identity; sameness in one or more respects, relation. The triangles in Euclid, i. 4, are by hypothesis related in a given manner in three particulars: a change of place shows that they can be made identical; that is, their difference before the change of place was difference of position only, not at all of form; in all that can distinguish one triangle from another, except its position in space, they are identical. We do not quarrel with the phrase that they are the same triangles differently placed, because sameness is understood with a reservation, and the preceding means that they are the same except in difference of place.

Words of identity are sometimes incautiously used to signify relations only, or words of more relation to signify less of relation: thus Euclid, who defines equality to consist in capability of coincidence, that is, in perfect sameness of form with difference of place, uses the word equal freely to signify nothing but equality of area, here meaning by equal equiareal. But we hold it to be exactly the same error to make a correction by introducing another general term in a limited sense; those for instance who have proposed *equivalent* instead of equiareal, have attempted to make a word which might stand for any relation of equality be confined to one of its particular meanings. In algebra there is a great want of terms, as well as of signs, significative of relation; we have in fact only one sign, =, and one phrase for it, *is equal to*. Hence proceeds either want of distinction between different relations, or the want of distinctness which arises out of such a generalization of the sign as will bring all its meanings under one.

In an algebraical expression we may have to consider its meaning, form, magnitude, source, mode of derivation, and properties. The meaning depends upon the fundamental definitions which are employed and the form; the form, upon the arrangement of the symbols; the magnitude, when magnitude is signified, upon the form and the particular values given to the symbols; so that these various sources of relation are closely connected with one another. The fundamental meaning of the sign = implies equality of quantity or magnitude, and some insist that it shall always retain this meaning. There can be no objection to any one insisting on this point for himself; but the learner, who, if he be wise, will learn all languages with the majority, even though he should afterwards teach with the minority, must make himself accustomed to various uses of this sign, as follows:—

1. The sign = means that on one side we have an operation to be performed, and on the other side the result of performing that operation by general rules, as in

$$(x+a)(x-a) = x^2-a^2 \qquad a^7 \div a^7 = a^0;$$

Whenever the resulting form is intelligible both in form and magnitude, the resulting relation is equality of magnitude under difference of form, independently of the particular values of the symbols; but when the result is unintelligible, as is the second of the preceding results when first obtained, this relation no longer exists: the process described in INTERPRETATION makes it exist. In all such cases the relation is that of sameness of value and properties, sameness in fact of everything but form; and the relation is independent of the magnitude of the algebraical symbols.

But did no relation exist in $a^2 \div a^2 = a^0$, until we had interpreted the then unknown symbol a^0 to mean unity? We answer, that a relation did exist, namely, sameness of properties. The value of the first side is unity: the unknown symbol of the second side would be found on trial to have all the properties of the unit, when common algebraical rules are applied. If we were to refuse the interpretation, and consider a^0 as a self-contradictory symbol, we could not deprive it of the properties of a unit, or rather, we could not deprive ourselves of the knowledge that the algebraical use of it would produce the same results as the algebraical use of a unit.

To the same head may be referred the meaning of =, as connecting an infinite series with its finite source of development (or its involopment). Arithmetical equality may not exist, for the series may be divergent; but between the development and its involopment exists the relation of sameness of properties, and the relation of sameness of source. The infinite series $1-1+1-1+$, &c. is equated to half a unit; that is, the sign = is put between $\frac{1}{2}$ and $1-1+1-1+$, &c. *ad inf.* The relation of sameness of magnitude has no existence, for $1-1+1-$, &c., *ad infinitum*, furnishes no definite idea of magnitude; but in properties, the two are the same. This subject will be considered more in detail in SERIES.

2. The sign = means the relation of sameness of magnitude, without reference to form, and in this sense its use generally imposes conditions on one or more of the symbols employed, and always does so unless when the sign might also truly have the meaning described under the first head. Thus $2x+3 = x+4+x-1$ imposes no condition on the value of x, because the first side is only a more simple performance of the operations indicated on the second side; but $2x+3 = 21-x$ is the assertion of a relation existing which is not true of the forms, and is not generally true as to the magnitudes. The condition $x = 6$ is necessary to the truth of the relation asserted to exist. Relations of this sort, under the name of equations, are the first which meet the student at his entrance into algebra, and he frequently has a subsequent difficulty in extending the use of the symbol =. Being accustomed to see it impose conditions of magnitude, he cannot easily cease to imagine that it always does so; and he looks upon the two equations

$$\varepsilon^x = 1 + x + \frac{x^2}{2} + \text{\&c.}, \quad \text{and} \quad x + 1 = 2,$$

as things of the same kind, differing only in complexity. To prevent this, the distinction between *identical* equations (so called), namely, assertions of the relation described under the first head, and equations *of condition*, should be strongly marked at the outset of his course. It would even be wise to use somewhat different symbols for the two relations; thus $=\!=\!=$ might denote the first described relation, and = the second. The learner might drop the slight distinction which exists between the two symbols when he finds himself able to do without it; but we are satisfied that those who had once learned to use it would never think the time was come when they might safely drop it.

3. The sign = means the relation of algebraical identity between the results of different operations, when the symbols are not symbols of magnitude, but of OPERATION: that is, it asserts the relation of sameness of effect between the two operations which are written on one side and the other of it. And here it is in truth used in the first sense described, the difference being in the meaning of the symbols, not in that of the relation. And here again there is the distinction between the case in which the relation is explicable from definitions, and that in which it requires interpretation. Thus in the relation $(1+\Delta)^2 = 1+2\Delta+\Delta^2$, we can prove and verify that the operation $1+\Delta$ is of that sort which if performed twice following, will yield the same result as the sum of the results of the operations 1, 2Δ, and Δ^2. But when, having established, as in the article cited, a right to the use of all the ordinary transformations of algebra, we come to $1+\Delta = \varepsilon^D$ and $D = \log(1+\Delta)$, we have results of which the first side only is explicable, and the second requires interpretation. It might be satisfactory to consider such symbols as $\log(1+\Delta)$, &c. in no other light than as abbreviations of the series into which they might be developed in common algebra; but as such a use of interpretation seems to a beginner to be more arbitrary than it really is, we may point out how to make the passage in a somewhat more guarded manner, presuming the reader to be perfectly well acquainted with the results of the article OPERATION.

If A, B, &c. stand for symbols of operation, then $A \pm B$, AB, $A \div B$, are compound results of operation, which are capable of and actually receive a distinct definition. Similarly A^n is also deducible in meaning from the definition when n is any number, whole or fractional, positive or negative; but A^B, where B is also a symbol of operation, cannot be immediately explained from definition. But it is to be remembered that an algebraic quantity may be susceptible of different definitions, though really amounting to the same definition. Sometimes nothing more than a mere change of the form of words will render a notion capable of being rationally extended further than it could have been before the change was made. For instance, in FRACTIONS, we understand the division of 7 into 3 equal parts, and into 4 equal parts; but a division into $3\frac{1}{2}$ equal parts is a set of words without meaning. But if we only speak of taking parts of which three make 7, and other parts of which four make 7, it is perfectly easy to imagine parts such that three parts and half a part make 7. Can we not then take such a method of defining A^B as, without in any way altering its common meaning, shall present that common meaning in a form which will be intelligible when A and B are symbols of operation.

In BINOMIAL THEOREM it is proved that the equation $\phi x \times \phi z = \phi(x+z)$ can only be satisfied for all values of x and z, by $\phi x = C^x$ where C is independent of x.

If then we propose the equation—

$$\phi x \times \phi z = \phi(x+z) \quad , \quad \ldots\ldots \ (1)$$

the only solution of both must be C^x. It is easy enough to show that—

$$C^x . C^z = C^{x+z},$$

the proof referred to shows that C^x is the *only* solution of this equation. If z and x be symbols of operation, and if by ϕx we mean a combination of operations performed with x, and by $\phi x . \phi z$ the result of successively performing the operations ϕz and ϕx, we may denote by y^x an operation which is such, that calling it ϕx, the successive performance of ϕx and ϕz is equivalent to that of $\phi(x+z)$; and that, calling it ψy, the successive performance of ψy and ψz is equivalent to that of $\psi(yz)$. If we want to define the particular operation A^x, we must add to the equation (1) the following—

$$\phi(1) = A.$$

Thus, let it be the definition of ε^D, D being a symbol of operation, that we have here an operation such that if it and $\varepsilon^{D'}$ were successively performed, the result would be the same as if $\varepsilon^{D+D'}$ were performed at once; this last symbol implying that the operation $D+D'$ is used in the same way as D in the first. Moreover, let it be understood that if D were 1, that is, if the operation D produced no alteration in the function operated on, the result of ε^D would be simple multiplication by ε. There is nothing in this definition which is unintelligible, though there is something unknown: An operation is defined by means of itself; the definition must then be developed before its object can be understood, but it is not the less a definition, that is, a description of some one operation, and a distinction between it and every other. Thus, in common algebra, the magnitude of x may be defined by an equation, say $x = 12 - x$. Here x is only given in terms of its unknown self, but it is not the less defined to be 6, and nothing but 6. When the step above described has been made, it is (owing to the demonstrated connection of the rules of common algebra with those of the calculus of operations), the same process to prove that

$$\varepsilon^D = 1 + D + \frac{D^2}{1.2} + \ldots$$

when D signifies an operation, as when it signifies a quantity.

The definition of log D is that this operation is the inverse of ε^D with respect to D; so that $\log \varepsilon^D$ means D. Those functions which in common algebra are trigonometrical [SINE] cannot be defined in the subject of which we are speaking, otherwise than by reference to the well-known exponential forms. Thus, D denoting an operation—

$$\text{Cos D means } \frac{1}{2}\left\{\varepsilon^{\text{D}\sqrt{(-1)}} + \varepsilon^{-\text{D}\sqrt{(-1)}}\right\}$$

$$\text{Sin D means } \frac{1}{2\sqrt{(-1)}}\left\{\varepsilon^{\text{D}\sqrt{(-1)}} - \varepsilon^{-\text{D}\sqrt{(-1)}}\right\}$$

It might perhaps be said that though we have constantly used the word relation, yet we have considered nothing but identity, that is, either identity of magnitude, form, process, or properties; but that the term in common life refers to something short of complete identity, frequently meaning mere connection, and sometimes only analogy, or even nothing more than resemblance. We answer, that relation always refers to identity of some sort. For example, there is a relation between the position of the sun and moon and the state of the ocean. Here the word means merely a connection; but this connection involves an absolute identity: having given the position of those heavenly bodies with respect to any place, together with the direction and quantity of their motions, the height of the water at that place is connected with the quantities which express those positions and motions by an equation or a mathematical identity. Resemblance again means identity in some respect, or near approach to identity: analogy, a term generally applied to relations of similarity, will be found to admit of the word sameness being used instead of similarity. Thus, when we say that substance is formed from *substare* in a manner similar to that in which distance is formed from *distare*, the analogy asserted is one of absolute identity (of mode of derivation).

Reasoning by analogy is either the same thing as common reasoning; or else analogy is but another word for induction. If A give B, and C have something in common with A, it may be a necessary consequence that C gives D; D being connected with C in the same manner as B with A. But this happens only when the following of B from A is a necessary consequence of that which A and C have in common, and of that only: in which case the deduction of D from C by analogy with the deduction of B from A, is only an assertion of the possibility of applying the same mode of proof to that part or property of C which was previously applied to the same part or property of A. But when we conclude by analogy of a horned animal that it is not carnivorous, as it is said; that is, when we conclude that the horned animal of which we speak will resemble all other horned animals which we know, in every point in which they resemble each other, we apply no other process than the establishment of a highly probable result by induction.

Reasoning by pure analogy is then not absolutely demonstrative reasoning, except in the case above described, in which we want no new name for the process. But attention to analogy in the structure of definitions, and in the route of investigation, is necessary to the success of many inquiries, and gives clearness and saves time in all. Indeed it may be taken as a maxim that whenever there is any species of resemblance pervading the results of two branches of inquiry, there ought to be a reason for that resemblance in the nature of the two subjects, expressed by a resemblance of the notations used; and this reason ought to be made prominent and insisted on.

For instance, we have two distinct *algebras* [NEGATIVE, &c. QUANTITIES], which, for temporary distinction, we may call arithmetical and geometrical, using the same symbols in the same manner, but proceeding upon meanings given to those symbols which appear altogether different. The only reason given to the student in the article cited, to justify the definitions of the latter, or geometrical algebra, was that they would be found to answer a certain purpose, namely, to make all theorems in the earlier algebra true, when no other alteration was made than that of the meanings of the symbols. It is now to be asked, why have the new definitions that property? what relation have they to the old ones which gives the results of the two a perfect community of form? The answer to this question is not very difficult; but it will require us first to consider what are the operations of common arithmetic, and how they are to be described in terms of the simplest notions of the science.

The fundamental operations of arithmetic are addition, subtraction, multiplication, and division. Of these we may make the definitions of subtraction and division follow from those of addition and multiplication: thus subtraction is the process which destroys the effect of addition, and division that which destroys the effect of multiplication. It may be said however that we can resolve all operations into one only, and its inverse: the direct operation being the simple repetition of a unit; and its inverse, the ascertainment of the quantity which will by simple repetitions make a unit. Since however the analogies with which we have here to do are not in any way connected with the distinction of whole numbers and fractions, we will confine ourselves to whole numbers, and, choosing a unit, make repetitions of that unit the sole objects of consideration.

The fundamental ideas of arithmetic are, first, that absence of all magnitude which must precede the consideration of any particular number; secondly, the particular magnitude which we choose for repetition, and to which we refer other magnitudes. Nothing and unity are the names of these ideas; and 0 and 1 are their well known symbols. The first, 0, reminds him who uses it, of the state in which he is antecedently to thinking of any number; the second, 1, of the successive accessions by which he passes from one object of consideration to another. If 0 do not present itself before we can think of any number, it is that we avoid it by an act of memory; but if, for instance, a person had forgotten what seven was, as a young child might do in learning arithmetic, he would be obliged, beginning from 0, to construct 7 by repeated accessions of a unit each time.

Now addition of one number to another is a process which merely puts a number in the place of *nothing*, and proceeds to count from that number in the same manner as when we form the number to be added from 0. Thus, to add *b* to *a* we do with *a* what we should have done with 0 to form *b*: to add 4 to 3, we do with 3 what we should have done with 0 to form 4. If this last operation were performed on the fingers, we should first complete three, and then count the fingers which make four from and after the completion of the three; thus—

$$4=0+1+1+1+1$$
$$3+4=3+1+1+1+1$$

This definition of addition, namely, that '$a+b$ is a direction to do that with *a*, which would give *b* if *a* were nothing,' will now be put by for a moment, until we are ready to apply it in the construction of the new algebra.

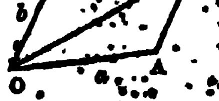
Multiplication of one number by another is a process which puts a number in the place of *unity*, and proceeds to use that number in the same manner as we use unity when we make another number. Thus, to multiply *a* by *b*, we do with *a* what we should have done with unity to make *b*; to multiply 3 by 4, we do with 3 what we should have done with unity to make 4. Thus,

$$4=1+1+1+1,$$
$$3\times 4=3+3+3+3.$$

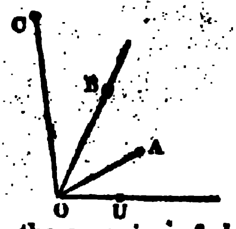
The definitions of subtraction and division are then obtained, as before described, by the supposition of inverse operations, or operations destructive of the effects of addition and multiplication.

In consequence of the preceding considerations, we shall pass from the limited to the more extended algebra without anything of any arbitrary character, except only the choice of a meaning for the fundamental symbols. In arithmetic, the symbols *a*, *b*, *c*, &c. mean simply numbers; let their meaning in the geometrical algebra be, not numbers but lengths, or if numbers, let them be numbers of lengths, a given length being taken as the unit. And let each symbol be expressive not only of a length, but of a length in some particular direction; by which we mean, that two lines are not to be denoted by the same symbol, unless they have not only the same lengths but the same directions. Imagine all lines to be drawn from a given point; then $a=b$ denotes coincidence of the lines *a* and *b*; that is, sameness of length and sameness of direction.

This one fundamental change in the meaning of the things signified by letters is now all that need be made; for all the rest is absolutely the same as in arithmetic. For example, what is $a+b$? Let OA and OB be the lines represented in length and direction by *a* and *b*; having completed



OA, that is, having passed from O to A through the proper length and in the proper direction, do that which would have given OB if OA had been nothing, or if A had been at O; that is, draw AC equal and parallel to OB, and in the same direction. The point C thus attained terminates a line OC, the length and direction of which is therefore to be denoted by $a+b$, since every process is to resemble that of arithmetic in everything but the meaning of the objects of calculation.



Again, required the meaning of ba? We must now choose a length and direction which is to be represented by 1; let this be OU. We are now to do with OA or a what we should have done with OU to make OB. Suppose for simplicity that OB is double of OU. To turn OU into OB, we must double its length, and let it revolve through a certain angle UOB. Do this with OA; that is, double its length, and make it, thus doubled, revolve to the position OC, so that the angles UOB and AOC are equal. Then OC must be that which is represented by ba; and the angle UOC is the sum of the angles UOB and UOA.

If we examine the fundamental definitions of the geometrically defined system of algebra [Negative, &c. Quantities, p. 133], we shall find that we have here described enough to deduce them all, and that we have done it by pure analogy. But also remark that analogy here means nothing but an identity of process; we have described the processes of addition and multiplication in terms which connect them so closely with the objects to which they are applied, and at the same time made the process so distinct from the subject-matters of the process, that when we change the subject-matter, we can still preserve the process. If then any other subject-matter could be found, such that, with reference to meanings of a and b derived from it, $a+b$ and ab could be consistently defined, or rather deduced, from 0 and 1, a new application of the rules of algebra would follow.

In the calculus of operations, the same steps might be made; and when this branch of algebra consisted of nothing but the separation of the symbols of operation and quantity in an arbitrary manner [Operation, pp. 442, 443], analogy was the species of relation by which the deduction of results from this separation was connected with the results of common algebra. But this analogy was only the guide to the results, and not the proof of them: it became a proof when it was shown that the validity of the common algebra itself depended, not upon the whole meaning of the symbols, but upon that part of it which was preserved in the meanings of the symbols of operation.

RELATION, RELATIONAL. [Notion, Notional.]

RELATIVE MAGNITUDE. [Ratio.]

RELATIVE MOTION. [Motion.]

RELATIVE PRONOUN. The relative pronoun is so called because it relates to some object mentioned just before, which object is usually termed the antecedent. The English language possesses two words for the relative pronoun, *who* or *which*, and *that*. The word *what* must also be regarded as a relative, for it evidently contains the same root as *who* and *which*; it is generally used in the sense of *that which*, as 'Let them say *what* they will.' The terms *who*, *which*, and *what* are also used as interrogatives, and contain the same root as the Sanskrit *ka-s*, the Greek ὅ-ς, the Latin *qui*, the Gothic *hver*, &c. The term *that* is evidently the same word as the demonstrative pronoun. In the same way we find that the Greek article, which was originally a demonstrative pronoun, is also used as a relative; and the German language likewise possesses two forms for the relative, *welcher* and *der*, the latter of which is also a demonstrative, and is the same word as the English *that*. According to Bopp (*Vergleichende Grammatik*, p. 553), the relative in Zend is also used as a demonstrative.

In English the relative is not unfrequently omitted. Thus most persons would say, 'The first school I was at,' and not 'The first school which I was at.' This omission is condemned by some grammarians, but is authorised by the usage of our best writers. The omission however seems only admissible in familiar speaking and writing, and is a great defect in any composition of a serious or elevated character.

RELATOR. [Information.]

RELEASE. 'Releases are in divers manners, viz.: releases of all the right which a man hath in lands or tenements; and releases of actions personals and reals, and other things.' (Litt. § 444.)

The former kind of release may be considered as a species of conveyance, and the instrument of release must be a deed. The operative words of release are *remise*, *release*, *renounce*, and for ever *quit claim* (an abbreviation or corruption of *quietum clamasse*). According to Littleton (§ 508) a release to a man of all demands is the best release that can be made, 'and shall enure most to his advantage;' but Coke remarks that 'claims' is a word of still more extensive import. The parties to a release are the releasor and releasee: the releasor is he who quits or renounces that which he has; the releasee is he who acquires what the other gives up, but he cannot acquire anything by the release, unless he has some estate in or right to the thing which is the object of the release.

Releases are either of an estate in land or of a right to land; or they are releases of things personal. Releases of estates in or rights to land require to be considered separately.

In order that a Release of an estate in land may have its intended effect, there must be privity of estate between the releasor and releasee; that is, the estates of the releasor and releasee must have been acquired by the same conveyance or title, or the one estate must have been derived immediately out of the other. There must be this privity whenever the Release of an estate operates either by way of enlarging the estate of the releasee, or by way of passing to him the estate of the releasor.

It is not in all cases necessary that the person to whom the release is made should be in the actual possession of the land or that he should have the estate immediately preceding that of the releasor. If land be given by C, who is tenant in fee-simple, to A for years, remainder to B for life, C may release his reversion either to A or to B: in the former case A will acquire the reversion expectant on B's life estate; and in the latter case B's remainder will merge in the reversion, which will become an estate in possession on the determination of A's estate. This is commonly called a release which enlarges an estate; but in the case supposed, if the release is made to A, his estate is not thereby enlarged, and the effect is just the same as if C made him a grant of the reversion. The rule of law is undoubtedly true that 'when ever a release doth enure by way of enlarging an estate, there must be privitie of estate, as between lessor and lesssee, donor and donee' (Co. Litt., 273, a); but there must also be privity, as in the case supposed, when no enlargement of the estate is made by the release. If C, tenant in fee simple, had originally granted the estate to B for life, and B had made a lease for years to A, a release of the reversion in fee from C to A would have no effect as a release, because there is no privity of estate, as above defined, between A and C. Such a release may however operate as a grant of the reversion, if there are sufficient words for that purpose. When lands are in possession of a lessee at will, for years, or for life, or of an assignee of such lessee, the lessor may release either to the lessee himself, or to his assignee. But a release by the original lessor to an under-lessee, as above stated, will not operate as a release. A copyhold tenant is, strictly, tenant at will to the lord who is the owner of the freehold, and therefore the lord may enfranchise the copyhold by release; but it is more usual to do it by lease and release, by way of greater caution.

In order that the release may operate to the enlargement of the estate of the releasee, it must contain proper words. Therefore if he who has the fee in reversion or remainder intends to release his estate to a tenant for years or for life, he must release to such tenant and his heirs. If he simply release to the tenant for life, the releasee will have no greater estate than he had before; and if he simply release to the tenant for years, the tenant acquires the estate only for life. (Litt., 468.)

If a lease is made, at common law, of lands in possession, the lessee has no estate till he enters, and therefore can accept no release from the lessor; but a release from the lessor to the lessee before entry of all his right in the land, extinguishes the rent. In the common conveyance by lease and release, it is usual to give the intended releasee an estate in the land for a year by bargain and sale, which by the statute of uses becomes a vested estate, and the bargainee is therefore qualified to take a release without actual entry, which would be necessary in the case of lands in possession, if the lease were made at common law, though not requisite in the case of a lease of lands in reversion.

A release may operate by passing the releasor's estate to the releasee, without enlarging the estate which the releasee already has; and this takes place in the case of joint tenants and coparceners. Joint tenants of an estate have one undivided title, and they can only convey their estates to one another by release. Coparceners have only one title, for they all make one heir, but they also transmit to their heirs separate estates. Accordingly coparceners can either release to each other or convey their estates by feoffment. In these cases it is not necessary to use any words of limitation in the release, for as the joint tenants and coparceners have all one title to their estate, whatever it may be, a release from one to another passes all the estate of the former to the latter, without any words of inheritance.

If there are three joint-tenants, and one of them releases his estate to another of them, such other becomes joint-tenant of two-thirds of the land with the remaining tenant, and he holds the released one-third as tenant in common with his remaining companion. If a lease be made to two persons, one may release to the other before entry; for there is privity of estate between them, and the release does not operate by enlargement, but by extinguishment of a right.

A man may release all his right in or to lands, and such release will comprehend all his rights at the time, but not future rights. An expectant heir cannot release the right which he may have to his ancestor's estate. A right, in order to be capable of being released, must therefore be an existing right and not a possibility. Sometimes however a release, though it cannot operate as such, may operate as an estoppel. In a particular case (Bensley *v.* Burdon, 2 S. and S., 519) a son was estopped under a release made by him in his father's lifetime, by the allegation of a particular fact, which was held to conclude the son who made it.

A right may be released to any person who has an estate in the land, either in possession, reversion, or remainder; but if the right be to an estate of freehold, it can only be released to a person who has an estate of freehold. Such a release will be for the benefit of all persons who are entitled to the land by the same means as the releasee.

There is also Release by act or operation of law, as it is termed; that is, from certain acts or events, which are not a direct release, the legal conclusion of a release follows. Instances of this kind of release often occurred in former times when disseisins were common, and the following is given as an example: if a disseisee disseise the heir of the disseisor, and make a feoffment, this amounts to a release of the right. (Co. Litt., 264, b.)

A Release, not considered as an instrument of conveyance, is the giving up or discharging of a right of action or suit which one man has against another. This release may be either by act of law or by deed.

If a creditor makes his debtor his executor or one of his executors, the debt is legally extinguished as soon as the creditor dies, though there can be no legal evidence of this extinguishment until the executor has obtained probate of the will. The ground of this legal conclusion is, the union of creditor and debtor in the person of the executor, who would be a necessary party to an action at law against himself. But in equity so far is the debtor from being released, that the debtor executor is considered to have received the debt, and to have it as assets in his hands. Accordingly in a suit in equity against him, he may be ordered to pay the amount of the debt into court, upon admitting it in his answer. If a debtor appoint his creditor his executor, the creditor executor, both at law and in equity, may retain his debt out of the assets which come to his hands, provided he does not thereby prejudice creditors of a superior degree. If a woman marries her debtor or creditor, the extinguishment of the debt is a necessary consequence.

In a Release of this kind also the proper words are *remise*, *release*, and *quit-claim*, but any words are sufficient for the purpose which clearly express the intention of the parties to the deed. If a man covenants with another that he will never sue him, this is legally construed to be equivalent to a release, because the same end would be ultimately effected by virtue of this covenant, as if there were an absolute release. But there are cases in which a perpetual covenant not to sue one debtor will not discharge a co-debtor. (Hutton *v.* Eyre, 6 Taunt., 289.) A covenant not to sue for a limited time cannot of course have the effect of a release.

All persons may release, who are not under some legal disability, such as infancy. A husband may release a debt due to his wife, because he is the person entitled to receive it; but his release of a debt due to the wife extends only to such debts as are demands at the time of the release. A partner, or other co-dettee, may also release a debt due to him and his co-partners. An executor may, at law, release a debt due to him and his co-executors as such; and one of several administrators has the same power: but such releases are ineffectual in equity, unless they are made in the due discharge of the executor's duty. Though one of several co-plaintiffs may release a cause of action, a court of law will set aside the release, if it is a fraudulent transaction.

A release may be set aside in equity on the ground of fraud, a term which will include every act of commission or omission that renders the transaction unfair, such as misrepresentation or suppression of facts important to be known to the releasor. A plea of a release is no answer to a bill in equity which seeks to set aside the release on the ground of fraud, or which, anticipating a plea of the release, charges that it was fraudulently obtained, unless the fraud which is charged is put in issue in the plea, and sufficiently denied by answer. The principle of this is fully and clearly stated by Lord Redesdale. (Roche *v.* Morgell, 2 Scho. and Lef., 730.)

It is a general rule that a stranger to a deed cannot maintain an action upon it; for covenants in a deed expressed to be made between parties do not give a right of action to a person not a party to the deed, though he is mentioned in it. This principle is applicable to the case of a release; for a release expressed to be made between certain parties cannot be pleaded as an answer to the claims of the releasor against a third party, even if such release should profess to discharge such third party from all such claims. A release made to one of several joint debtors who are also severally bound, discharges them all, and the reason given is, that 'in such a case the joint-remedy being gone, the several is so likewise;' the rule applies to releases by operation of law, and is true in equity also.

The releasor may have demands against another, both in his own right and in another right, such as that of executor for instance; and accordingly a question sometimes arises whether the release extends to demands in both rights, when the release contains no clear declaration of the demands to which it extends. If this ambiguity exists, it seems to be settled that the release will only extend to such claims as the releasor has in his own right, if he has any demands in both rights; but if he has only demands in right of another, the release will operate upon them. If a man who has a rent-charge issuing out of a certain number of acres of land, releases his right in any part of the land, he releases all the rent, for it is charged on all the land, and not on any part. A release of all demands means all demands which exist at the time of the release, and it does not extend to anything which, at the time of the release, is not a demand, but afterwards becomes a demand. It is generally considered that a release of all demands would extend to a rent-charge, or a rent-service, parcel of a seignory in gross (but not to a rent-service incident to a reversion), but a release of all actions could not extend further than to a release of arrears of rent then due. Though a release of all actions is not a release of a sum of money not then due, it is said that such a release made before the day of payment appointed by the condition of a bond would be effectual: a bond being an acknowledgment of a present debt, defeasible by a condition subsequent, which does not prevent the right of action from vesting in the mean time.

A release is generally so expressed as to include all demands up to the day of the date of it; but in this case the day of the date is excluded from the computation. If the release extends to all demands up to the making of the release, this will comprehend all demands up to the delivery of it.

It is usual for releases to contain very general words which, in their literal signification, may comprehend thing that the releasor does not intend to release. But wheneve it can be clearly shown, as for instance by a particular re cital in a deed, that the general words of release were intende to be limited, such construction must be put on them. Parc evidence is not admissible for the purpose of limiting or ex larging the words of a release; but, as in the case of wills, it may be admitted where a difficulty arises in applying the words of the instrument to the facts of the case, for which purpose the state of the facts at the time of the release must be ascertained by extrinsic evidence.

RELICS (in Latin, 'reliquiæ') is a term used to signify the remains, bones, or garments of departed holy men, which are honoured by the followers of the Church of Rome. During the first ages of the Christian Church, martyrs were held in veneration; and their relics were treasured up as something sacred. The anniversary of their martyrdom was celebrated by assemblies of the faithful, held round their tomb or on the places where they had perished, and chapels and sanctuaries were raised on the spot. The blood of the martyrs was eagerly collected with sponges, and other demonstrations of religious enthusiasm were exhibited; but the church had not sanctioned any worship of those mortal remains. In the fourth and fifth centuries the previous veneration for the saints became a kind of worship with many people; astonishing miracles were said to be performed by fragments of their bones or garments, and pilgrimages were undertaken to obtain these relics. Helena, the mother of Constantine, went to Palestine, and is said to have found the identical cross on which Christ suffered. [PILGRIM.] The use of images and that of relics as accessories to church worship seem to have grown up together during that period. Towards the end of the sixth century, Pope Gregory I. displayed a great veneration for relics. There is a letter of his to the empress Constantina, who had asked him for a part of the body of St. Paul, in which he excuses himself by saying that it was not the custom of the Romans, and, in general, of the Christians of the West, to touch, much less to remove the bodies of saints; but that they put a piece of linen called 'brandeum' near the holy bodies, which is afterwards withdrawn, and treasured up with due veneration in some new church, and as many miracles are wrought by it as if the bodies themselves were there: he adds that they were much surprised at the Greeks removing the bones of saints from place to place; but that in order not to disappoint the piety of the empress, he would send her some filings of the chains which St. Paul wore on his neck and hands. This letter is quoted by Baronius, Fleury, and other church historians. From that time the veneration for relics increased, till it became, during the middle ages, a vulgar superstition and disgraceful traffic; and the abuse has been censured by many sincere Roman Catholics. It was ordered by several synods that no relics should be exposed to view without the sanction of the local bishop. Pope Innocent III. forbade the sale of relics. The Roman Catholic Church however admits that the relics of saints have performed and may still perform miracles; and that they are a proper object of veneration.

(*Bibliothèque Sacrée, par les Pères Richard et Giraud*, articles 'Reliques' and 'Saints,' 3rd section, 'Reliques des Saints;' and also Father Honoré de Sainte Marie, *Dissertation sur les Reliques;* and the Abbé de Cordemoi, *Traité des Saintes Reliques*.)

RELIEF, RELE'VIUM, a burthen incident to feudal tenures, being a sum of money paid to the lord on the admittance of a fresh tenant. It is a relic of that state of things in which the succession was not strictly speaking of right, but at the will of the lord, who required the payment of such an acknowledgement for the concession. It became however so much the custom for the lords to admit the sons or near kindred (heirs, as we now say) to the inheritance of the ancestor, that a custom became established of doing so, and out of the custom grew the right of inheritance. The money however which had been paid for admission in the former state of things, continued to be paid when the succession of the next heir had become what is called matter of right.

Bracton gives what is probably the true etymology of the word. 'Relevia,' says he, are so called, 'quia hereditas quæ jacens fuit per antecessoris decessum, *relevatur* in manus heredum, et propter factam relevationem.'

RELIEF. [BASSO RILIEVO.]

RELIGION is a Latin word which, according to the common derivation of it (from *religare*), means a principle which acts as a *restraint* on the conduct of man. In its more general sense it is used as an abstract term to denote our ideas of the existence and character of a Divine Being, to whose power men are more or less subject. Thus we speak of *a sense of religion* and *the duties of religion*, and we call a man who regards such subjects as matters of grave importance *a religious person*. But as different views have prevailed of the nature of the deity and the relation in which man stands to him, various systems of religious belief have sprung up, and each of these systems is called *a religion*. Thus we speak of the Greek, Hindu, Jewish, Christian, and Mohammedan religions. The word is also popularly used to express the attention of individuals to the doctrines and duties of the particular religion which they may have embraced. In this sense it is synonymous with *piety*.

The subjects with which religion has to do are God and man considered in the relation in which they stand to each other. It consequently includes all the philosophical questions which can throw light upon that relation; for example, those which respect the nature of the deity, the notions of infinite space and infinite duration, the existence and offices of spiritual beings, the origin and destiny of the human race and of the world they inhabit, the immateriality and immortality of the human soul; and also all the practical questions which arise out of that relation, such as the duties which men owe to God and to each other, and the consequences which God may have appointed to follow different courses of action. All impressions, notions, and belief upon these subjects, whether formed into a system or not, constitute what we call *religion*, as distinguished from *theology*, which is the science by which these ideas are reduced to a systematic form, their laws investigated, and their origin and results traced out. [THEOLOGY.]

The sources from which our notions of religion are derived are either the so-called laws of nature and the constitution of the human mind, or direct information given to us upon the subject by the deity himself, whether such information be embodied in any lasting form, or handed down from one generation to another by oral tradition. Religion derived from the two former sources is called *natural religion;* from the last, *revealed religion*. [REVELATION.]

The fundamental principle upon which all religion rests is the notion of the existence of a Being whose power over us is absolute, whose nature is either perfect in excellence, or at least far superior to ours, to whom we owe certain duties, and from whom we have much to hope and fear. The existence of such a Being is proved by the evidences which the objects of nature present of perfect design, of fixed order, of power sufficient to accomplish everything which we can conceive that does not involve a contradiction, and which we therefore conclude to be infinite, and of benevolent provision for the wants of living creatures. Apart from all such evidence, the belief in the divine existence seems to be strongly impressed on the human mind, so strongly indeed, that it is a matter of great doubt whether even professed atheists have been really such. Lastly, this truth may be the subject of revelation; for revelation does not, as may at first sight seem, imply as a fact *previously* known the existence of the Being from whom it comes. To the first recipients of the revelation the very fact of their finding themselves possessed of the knowledge of truths beyond the range of human experience would be a sufficient proof of the existence of a superior Being, from whom they had, in whatever way, obtained such knowledge; and if, in making known the revelation to the world, these persons should display a command over the laws of nature beyond the compass of human power, or an acquaintance with future events beyond the reach of human knowledge, these miracles and prophecies would prove the existence of a superior Being, from whom they had received the power to perform the one and the foreknowledge implied in the other. Thus the revelation itself furnishes a proof of the existence of the before unknown revealer. We do not inquire whether the divine existence is really proved in either or all of these different ways, because the object of this article is to explain the nature of religion, not to establish its truths.

The belief in a God leads at once to the practice of worshipping him, on the very same principle on which all dependents honour and look up to those in whose power they are placed.

The existence of a God once proved, the next question is, In what relation do we stand to him? Are any laws laid down for our conduct? Are we responsible to him for keeping or breaking those laws? Are any rewards and punishments appointed for obedience and disobedience?

To these questions it does not appear that natural religion can give a perfectly satisfactory answer, though no one can read Bishop Butler's admirable work, 'The Analogy of Religion, Natural and Revealed, to the Constitution and Course of Nature,' without being astonished at the amount of information on these subjects which it is there shown that the contemplation of natural phenomena reveals. It seems also that a general undefined notion of responsibility is associated in nearly all human minds with the idea of divine existence, at least a sense of responsibility sufficient to excite pleasure when we do what we believe to be good, and remorse when we do what we believe to be evil. Again, the connection which we find generally existing between vice and misery on the one hand, and virtue and happiness on the other, impresses upon us the idea that there does exist such a thing as retributive justice. But at this point we encounter the great difficulty of natural religion. Though the general law according to which the affairs of the world appear to be governed is, that virtue is followed by happiness, and vice by misery; and though a full knowledge of the circumstances of every case which appears an exception to that law might show us that more real happiness is enjoyed by a virtuous sufferer than by a prosperous sinner, yet it cannot be denied that daily experience furnishes us with exceptions to this law, numerous enough to throw great doubt upon its reality, if the period of human existence ends with the present life. Accordingly we find the doctrine of a future state forming a part of all religious systems, and generally connected with some notion of rewards and punishments. And this again is a branch of religion which, though it may be made to appear probable by arguments drawn from nature (we must again refer the reader to Bishop Butler's work), does not appear to be susceptible of satisfactory proof without a divine revelation. In the opening of the Epistle to the Romans there is an admirable though concise argument on the force and extent of natural religion (*Rom.*, i. 19): 'Because that which may be known of God is manifest in them; for God hath showed it unto them. For the invisible things of him from the creation of the world are clearly seen, being understood by the things that are made, even his eternal power and Godhead; so that they are without excuse: Because that, when they knew God, they glorified him not as God, neither were thankful; but became vain in their imaginations, and their foolish heart was darkened.' And again (*Rom.*, ii. 14): 'For when the Gentiles, which have not the law, do by nature the things contained in the law, these, having not the law, are a law unto themselves: Which show the work of the law written in their hearts, their conscience also bearing witness, and their thoughts the meanwhile accusing or else excusing one another.'

Now if there be a supreme moral governor who rules the world by fixed laws, who has appointed rewards and punishments as the recompense for obedience and disobedience, and who has constituted man so that he shall exist in a future state to receive that recompense, the question is naturally suggested whether there be any means by which the consequences of disobedience may be averted. The experience of human governments proves that it would be unsafe to pardon a criminal merely upon his repentance; and analogy would therefore lead us to conclude that so loose a principle of forgiveness cannot be admitted into the divine government. Or even if this principle might be safely acted upon in some few cases, we should gain nothing more than a vague hope of mercy, being still left without any reasonable ground for expecting it. Justice must be an attribute of the ruler of the universe, and natural religion affords us sufficient proofs of his goodness to justify us in believing that he is also willing to show mercy. The question that remains to be answered is, how his mercy can be shown without injury to his justice; and the importance of this question is enhanced by the consideration that the great majority of mankind (experience would justify us, apart from the Christian doctrine of universal depravity, in saying all mankind) need the divine forgiveness for at least some actions of their lives. It is the highest province of religion to furnish an answer to this question; and here natural religion entirely fails us, for if left to it, the utmost we could do would be to rest in the exercise of an humble faith that some provision has been made by God for the just forgiveness of our sins, though the nature of that provision be unknown to us. The matter belongs to revealed religion, and accordingly we find in nearly every r[illegible] to have a divine origin, and in many others, the doctrine of an atonement; that is, of a satisfaction for sin, in virtue of which the actual transgressor may be released from the consequences of his guilt.

On whatever grounds systems of morality may be based by ethical writers, it is beyond a doubt that in the minds of men in general there is an inseparable connection between religion and morality, the former furnishing alike the rule and sanction of the latter. The positive morality of any people will always depend on the nature of their religion. The attributes which they attach to the divine character will be a standard for their own conduct, and their opinions respecting the recompense appointed for virtue and vice will determine the strength of the motives on which they act; while their moral system will be greatly affected by their views upon the subject of satisfaction for guilt. When, as is generally the case, the same religious principles are found to pervade a whole community, the positive morality which is formed upon those principles has a direct influence on legislation, and the sanctions and rites of religion are brought by the legislator to aid in working out his institutions, and thus religion becomes interwoven with the social and political system.

These then are the elements which seem to be contained in any religion suited to the wants of man; that there exists a supreme Being who possesses absolute power over man and the material universe, and all creatures therein, and who is to be worshipped by all his rational creatures; that he has laid down laws for our conduct, by our obedience or disobedience to which we subject ourselves to a recompense of reward or punishment, which recompense is awarded partially in the present life, but more completely in a future state, in which we are so constituted as to exist after death; that a provision has been made on behalf of those who feel that their conduct has subjected them to the divine displeasure, by availing themselves of which they may escape the consequences of their guilt without detriment to the equity of the divine government; and lastly, that there are certain practical rules of conduct by which the intercourse of men with each other ought to be governed, and by an attention to which the stability of the social system may to a great extent be ensured. And all these elements of religion are susceptible of proof, either from nature, or from human experience, or from revelation.

When we look at the different religious systems which have prevailed among the various divisions of the human family, we find the fundamental idea of the divine existence contained in them all; for the testimonies of modern travellers and of antient history concur to show that, as far as our knowledge extends, there is not nor ever has been a people utterly ignorant of the divine existence, however debased in other respects. Even where polytheism and idolatry have existed in their grossest forms, we can generally trace some notion of a supreme divinity, who is regarded as the origin of all other existences. The character of the worship which is paid to the divine Being is always found to be materially affected by the difficulty of conceiving spiritual objects. Hence the almost universal prevalence of idolatry; of which the earliest form appears to have been the worship of the heavenly bodies, which, as being the sources of light and heat and all vivifying power, were regarded as the fittest representatives of the deity. Then came the worship of the powers and objects of nature in general. The heaven, earth, and seas, the mountains, woods, and rivers, were peopled with divinities, and these were multiplied by assigning to many of them fixed abodes in particular places. Virtues and vices, passions and emotions, and even ordinary occupations, were all personified as deities, so that scarcely a feeling or action was left without some divinity who was supposed to regulate it. It would seem too that the general doctrine of the divine government and protection has not been sufficient to satisfy mankind: they seem to want to have the deity brought nearer to them, and therefore nearly every religion presents us with a class of beings intermediate between God and man, under whose immediate care the latter are placed, and thus we get guardian deities of countries, cities, families, individuals, and classes. The next step is the bringing these divinities into closer connection with the senses by adopting some material object to represent them, either a symbolical image, a statue, or picture in the form of man, or even a living animal. This is the general character of the religious systems which existed from the first beginning of idolatry to the period when Christianity became widely diffused (excepting of course the Jewish religion), and which still exists among most of the nations which have not received either the Christian or Mohammedan faith. In nearly all such systems we find especial honours paid to the reproductive powers of nature, which are often worshipped under the grossest forms, as, for example, in the Hindu religion, and in the worship of Baal and Ashteroth among the Phœnicians, and of Dionysus among the Greeks. In religions which teach a plurality of gods, the deities are generally represented as being more or less in a state of opposition to each other. This feature has probably arisen from the apparent mutual opposition of some of the forces which are found at work in nature, and from the poetical representations of early mythologers. The ultimate effect of such views of the divine nature has been to invest the character of the deities with those attributes of virtue and vice which belong to man, leaving the former only superior to the latter in their greater power and more lengthened existence. As a general principle, we find that the views which all nations take of the divine character bear a close analogy to the light in which they regard the phenomena of nature.

In most religions the existence of evil in the world is traced to the malignant efforts of a bad Being, who is viewed either as permitted to do evil for a time, with a view to the ultimate accomplishment of greater good, or as being independent in his origin and power of the good divinity, or even as so powerful that some nations have sought to appease him by divine honours.

Those religions which are based upon the doctrine of the unity of the deity, are chiefly distinguished from the polytheistic systems by their regarding the divine nature as utterly distinct from all material existences, and as incapable of being represented in any way by means of sensible objects. Hence the Jewish and Christian and Mohammedan religions are irreconcileably opposed to all forms of idolatry.

The different views which are taken of human duty and responsibility, and of the future state of existence, are generally found to depend upon the light in which the deity is regarded. It is not to be expected that men should measure their conduct by the standard of a purer morality than is furnished by the characters of their gods. Accordingly we find in all nations whose religion is polytheistic, that their positive morality has been low, and that their belief in an equitable divine government and in a future state of retribution has been most confused and vague. It is in Christianity alone that we find a code of morals based on the principle of universal love, and a clear announcement of a future state of rewards and punishments.

With regard to the doctrine of satisfaction for sin, we find in most nations some traces of the belief that 'without shedding of blood there is no remission;' and, as a consequence of this belief, the practice of propitiating the deity by sacrifice. In no religion however, except Christianity, do we find any clear or consistent doctrine of the means by which an atonement is provided, and of the course through which individuals must pass to secure the benefits of that atonement. [ATONEMENT.]

In their influence upon the social system, all religions, except Christianity, appear to have failed in producing that spirit of self-restraint and benevolence which is the best security for the peace and prosperity of any community. But in instituting a comparison on this point, we must not judge by the state of things existing in any community which *professes* a certain religion, but we must inquire whether in that community the religion in question exists in a genuine form, as determined by the documents in which its principles are embodied, or by any other test of acknowledged authority. If, for example, there exist any sacred books to which all the professors of any religion appeal as containing the tenets of their religion, we must first refer to them to test the purity of the religious system of a community, before we judge of the influence of that system on society. Tried by this test, we believe it will be found that Christianity, in proportion to the purity in which it has existed in any nation, has tended to produce peace and contentment, benevolence and industry, submission to the authority of the law, and regard for the rights of every class and individual, to an extent never approached by any nation professing a different religion. But, whatever views may be entertained of the respective powers of different religions in keeping a social system together, this fact at least seems established by evidence, that this object cannot be effected without some religion. All great legislators have used religion as the great bond of their institutions, [illegible], in which religious considerations have been the means of accomplishing or frustrating great political objects. Of the converse experiment we are almost without an example. But it is very probable that the anarchy of the French 'Reign of Terror,' in which the social system was for a time dissolved, had its chief cause in the general prevalence of infidel sentiments among the people.

The limits of this article will not allow of a detailed examination and comparison of the tenets of different religions. An account of the religions of the principal nations of the world will be found under their respective articles. To those articles the reader is referred for the facts by which he may judge of the opinions which are here expressed.

REMAINDER. An estate in remainder is defined by Coke to be 'a remnant of an estate in lands or tenements, expectant on a particular estate, created together with the same at one time.' According to this definition, it must be an estate in lands or tenements, including incorporeal hereditaments, as rents and tithes; and it is an estate which at the time of its creation is not an estate in possession, but an estate the enjoyment of which is deferred. The estate in remainder may exist in lands or hereditaments held for an estate of inheritance or for life. It must be created at the same time with the preceding estate, and by the same instrument; but a will and a codicil are for this purpose the same instrument. A remainder may be limited by appointment, which is an execution of a power created by the instrument that creates the particular estate; for the instrument of appointment is legally considered as a part of the original instrument. A remainder may also be created either by deed or by will; and either according to the rules of the common law, or by the operation of the Statute of Uses, which is now the more usual means.

If a man seised in fee simple grants lands to A for years or for life, and then to B and his heirs, B has the remainder in fee, which is a present interest or estate, and he has consequently a present right to the enjoyment of the lands upon the determination of A's estate; or, in other words, he has a vested estate, which is called a vested remainder. A reversion differs from a remainder in several respects. He who grants an estate or estates out of his own estate, retains as his reversion whatever he does not grant; and upon the determination of the estate or estates which he has granted, the land reverts to him. There may be several remainders and a reversion expectant on them. If A, tenant in fee simple, limits his estate to B for years, with remainder to C for life, with remainder to D in tail, this limitation does not exhaust the estate in fee simple. By the limitation B becomes tenant in possession for years, C has a vested remainder for life, D a vested remainder in tail, and A has the reversion in fee. If the limitation by A exhaust the whole estate, as it would have done in the preceding instance if the limitation had been to C and his heirs, A has no estate left. It is a necessary consequence that if a man grants all his estate, he can grant nothing more; and therefore the grant of any estate after an estate in fee simple is void as a remainder. Indeed the word remainder implies that what is granted as such is either a part or the whole of something which still remains of the original estate.

The estate which precedes the estate in remainder or in reversion is called the *particular* estate, being a particula or portion of all the estate which is limited; and the particular estate may be any estate except an estate at will, and an estate in fee simple. It must therefore be either an estate for years, or for life, or in tail.

Estates for years may be granted to commence at a future time; but by the rules of the common law, no estate of freehold can be created to commence at a future time. If therefore such an estate of freehold is granted, there must be created at the same time an estate for years, which shall continue till the time fixed for the enjoyment of the estate of freehold. If a freehold remainder expectant on an estate for years is created at common law, there must be livery of seisin to the tenant for years, for it is necessary that the freehold should pass to the grantee at the time of the grant, and the livery to the tenant for years enures to give a seisin to him to whom the estate of freehold is granted.

A remainder cannot be granted so as not to take effect immediately on the determination of the particular estate. If there is any interval left between the particular estate and the remainder in their creation, the remainder is absolutely void. A grant of an estate to A, and one day after the determination thereof to B, is a void remainder.

Estates in remainder are either vested or contingent. The remainder may vest, at the time of the limitation, or it may vest afterwards: in either case the remainder-man acquires an estate in the land, to the enjoyment of which he is entitled upon the determination of the preceding estate. But it may happen that a vested remainder may never become an estate in possession.

A vested remainder is an estate which, by the terms of the original limitation or conveyance, is limited or conveyed unconditionally. If a remainder is not vested, it is contingent.

A contingent remainder is defined by Fearne to be 'a remainder limited so as to depend on an event or condition which may never happen or be performed, or which may not happen or be performed till after the determination of the preceding estate.' Accordingly it is the limitation of the remainder which is conditional, and there is no remainder limited or given until the condition happens or is performed. The uncertainty of the remainder becoming an estate in possession is no part of the notion of a contingent remainder; for this kind of uncertainty may exist, as already observed, in the case of vested remainders.

Fearne has made four classes of contingent remainders, to some one of which he considers that all kinds of contingent remainders may be reduced, but he adds that 'several cases which fall literally under one or other of the two last of those four descriptions, are nevertheless ranked among vested estates.'

The first class is, 'where the remainder depends entirely on a contingent determination of the preceding estate itself;' or, as it may be explained, where a remainder is limited to take effect only on the happening of a specified contingent event which is to determine the preceding estate, and is not to take effect if the preceding estate determines in any other way. An example usually given is the following A makes a feoffment to the use of B till C returns from Rome, and after C's return, then to D in fee. In this case B has an estate which will determine either upon C's return from Rome or by his own death; but the remainder is limited to D only upon the happening of a specified event which may never happen; and if B's estate determine by his death, or by forfeiture, which is possible, no estate is limited to D. There is then no limitation to D, except conditionally, and his estate is therefore contingent.

The second class is, 'where some uncertain event, unconnected with and collateral to the determination of the preceding estate, is by the nature of the limitation to precede the remainder.' This class is easily distinguished from the first, by the circumstance that the uncertain event upon which the remainder is limited, is entirely independent of the manner in which the preceding estate may or must determine. The following is an example: If a grant is made to A for life, remainder to B for life, and if B die before A, remainder to C for life, the uncertain event of B's dying before A is quite independent of the determination of A's estate, but the limitation of C's estate depends on this uncertain event happening.

In both these classes of remainders, the event on which the remainder is to take effect is absolutely uncertain; in the two following classes, the events on which the remainders are limited are events which certainly must happen, and the contingency arises from the uncertainty of the time when they will happen.

The third class is, 'where a remainder is limited to take effect upon an event, which, though it certainly must happen some time or other, yet may not happen till after the determination of the particular estate.' The following is an example:—a grant is made to J. S. for life, and after the death of J. D. the lands to remain to another in fee. Though it is certain that J. D. must die, this event, upon which the limitation in fee is to take effect, may not happen till after the determination of the life estate of J. S.

The fourth class is, 'where a remainder is limited to a person not ascertained, or not in being at the time when such limitation is made.' The following is an example:—a grant is made to A for life, remainder to the right heirs of J. S. Now as J. S. can have no heir till he is dead, and as he may not die till after the determination of the particular estate, such remainder is contingent. If an estate is limited to two persons for life, with remainder in fee to the survivor, the remainder is contingent, because it is uncertain which will be the survivor.

The first class of remainders mentioned by Fearne has sometimes been confounded with cases of conditional or contingent limitations, which, though not valid in conveyances at common law, are valid within certain limits in wills and in conveyances under the Statute of Uses. The distinction between the two things may be somewhat difficult to apprehend, but still there is a substantial distinction.

In the first class of remainders, the estate in remainder is limited to take effect as a remainder upon a determination of the preceding estate according to the original limitation: it does not defeat or abridge the preceding estate, but it is limited to commence when the preceding estate determines by the happening of that contingency which is originally declared to be *a* limit of its duration. In the case of conditional limitations, the event on which the conditional limitation is to take effect is an event independent of the measure of the previous estate, which measure is precisely ascertained by the terms of the original limitation. In the case of a contingent remainder, the second limitation takes effect as being a remnant which exists, and is capable of being limited over upon the contingent event taking place. If the first estate be limited in fee, as a limitation to the use of A and his heirs till C returns from Rome, and after the return of C, to the use of B in fee, this limitation to B cannot be a remainder, because the whole estate has been already limited, and there is nothing left to limit over. If the limitation is to A for life, and if C return from Rome, then to B in fee, the life estate of A may be defeated by the return of C, in which event B's estate commences, and is not merely a remnant limited on the expiration of A's life estate, but it comprises part of the estate limited to A: it is therefore not a remainder according to the definition. Both these are cases of conditional limitation, by which an estate of a definite measure is limited, and upon the happening of some event which in no way affects the original measure of the preceding estate, that estate is to determine before its regular determination according to the original limitation, and the estate so conditionally limited is to take effect in possession. It follows from what has been said, that a remainder cannot take effect at common law so as to defeat or abridge the particular estate: a limitation having that effect would not be a remainder, but if limited at common law would be void; and if limited by a will or by a conveyance to uses, it would take effect in another way.

The exception to the third class of contingent remainders is of this kind. The event on which the remainder is limited over, is an event which must happen some time, and may happen after the determination of the particular estate the remainder is therefore strictly contingent. But if the probability of the event happening after the determination of the particular estate is very small, the remainder is held to be vested. The following is an example:—a limitation to A for eighty years, if B shall so long live; and after the death of B, to C in fee. In this case B, a person in being, may outlive the utmost limit of A's estate (eighty years); but the probability of this event is very small, and accordingly C's estate is held to be vested.

The numerous exceptions to the fourth class of contingent remainders are comprehended in what is called the Rule in Shelley's case, of which a complete exposition is given in Fearne's 'Essay on Contingent Remainders;' and in Preston's 'Treatise on Estates' (vol. i.). The nature of this rule may be generally stated as follows:—If lands are limited, either by deed or will, to a man for life, and after his death to his heirs or the heirs of his body, the limitation to the heirs would appear to be a contingent remainder according to the definition of the fourth class of contingent remainders, for the heirs are persons who cannot be ascertained till the death of the person to whom the estate for life is given. But it is an old rule of law that the estate so limited to the heirs or the heirs of the body takes immediate effect as an estate in the ancestor, and therefore, in the former case, A takes an estate of freehold with a vested remainder in fee. His life estate is consequently merged in his remainder in fee, and he becomes tenant in fee simple in possession. If an estate for life, or an estate tail, is interposed between the estate for life to the ancestor and the remainder to his heirs or the heirs of his body, still this remainder is vested in the ancestor, just in the same way as if it were limited to him and his heirs, or to him and the heirs of his body. Thus when A takes an estate for life, remainder to B for life, remainder to C in tail, remainder to the right heirs of A, this ultimate remainder is a vested remainder in fee in A, and, after his death and the determination of the intermediate estates, his heir will take by descent. But cases within this rule are not so properly exceptions, as cases which by the operation of the rule are excluded from the fourth class of contingent remainders.

There is another exception to the fourth class, which is allowed in devises, where it can be clearly inferred from the particular expressions in the will, that a limitation to the heir special of a person then living is intended as a designation of a particular person. In such case the remainder will vest; for the conclusion is, not that the testator intended to limit the estate by way of contingent remainder to such person as should be ascertained to be heir by the death of his ancestor, but that he intended by the word 'heir,' accompanied with the other expressions in the will, to designate a particular person.

The following is an apparent exception to the first class of contingent remainders. In settlements lands are often limited to the use of A for life, and after the determination of that estate by forfeiture or otherwise in his lifetime, to the use of B and his heirs during the life of A, in trust for A, and to preserve the contingent remainders; and after the death of A, to the use of the first and other sons of A successively in tail male, &c. This estate to the use of B and his heirs during the life of A is the estate given to trustees to support the subsequent contingent limitations; and in order that such estate to B and his heirs may be sufficient for the purpose, it must be vested. Accordingly it has long been held that this limitation gives the trustees a vested freehold estate, which will therefore support the contingent remainders. The reason given by Fearne for this estate being vested is, that the trustees have a present capacity to take the estate whenever it becomes vacant. He observes, 'The present capacity of taking effect in possession if the possession were to become vacant, and not the certainty that the possession will become vacant before the estate limited in remainder determines, universally distinguishes a vested remainder from one that is contingent.' (p. 216.)

If we adopt this test, it is clear that the limitation to trustees to preserve contingent remainders is not a limitation of that kind which is included in the first class of contingent remainders, for the limitations in remainder of that class are to take effect as limitations only on the happening of a specified contingent event which determines the preceding estate, and not on the happening of other events which may or must determine the preceding estate. If then a limitation over is to take effect on the happening of an uncertain event, and not on the happening of any other event, there is nothing limited as a remainder till the uncertain event has happened. But the estate to the trustees is so given as to take effect as a limitation upon any event happening which shall determine the estate of A in his lifetime. There is therefore a clear distinction between the two cases as to the capacity of taking effect in possession. But this capacity of taking effect in possession whenever the preceding estate becomes vacant, can hardly be used as a means of ascertaining whether the trustees have a vested estate. An estate is vested when there is either a present right of present enjoyment or a present right to a future enjoyment. A vested remainder is not the former, but it is the latter: the right is ascertained and the enjoyment is merely deferred. But the present right to a future enjoyment is a present capacity to enjoy whenever the time for enjoyment comes. Therefore a present capacity to enjoy if the possession becomes vacant is a vested remainder, and a vested remainder is a present capacity to enjoy if the possession becomes vacant; but whether in a given case such present capacity or such vested remainder (which is the same thing) actually exists, is the matter to be determined. The rule then which is to be the test whether a remainder is vested or contingent, is merely a description of a vested remainder in other and equivalent words; and the conclusion is that a remainder is vested and not contingent when it is vested. Now, as the very notion of a contingent as distinguished from a vested remainder depends upon the limitation of the remainder being conditional or unconditional, it follows that there is no test of a contingent as distinguished from a vested remainder, except by means of the words in which the limitation of the remainder is expressed.

An estate to A for life, with remainder to B during the life of A, would be a void remainder, but for the legal possibility of A's estate being forfeited or surrendered in his lifetime. This legal possibility is also considered as one of the regular modes in which A's estate may determine, that is, as one of the modes by which it is liable to determine according to the nature of the original limitation. For if it is not so considered, the estate to B is in the nature of a conditional limitation. Now, an estate might be limited upon the determination of A's life estate by forfeiture or otherwise in his lifetime, either for the period of A's life, or for a longer period than A's life, as for instance to B and his heirs. But such a limitation to B and his heirs is in the form of a contingent remainder, for by the terms of the limitation it is made upon a condition which may never be fulfilled; and there is a mode by which A's estate must determine, namely, his death, in which event nothing is limited to B and his heirs. If the estate to B and his heirs were limited upon any determination of A's estate in his lifetime, or upon the death of A, it would be a vested remainder, for it would be limited in all events, and therefore not conditionally limited. Now, the estate to the trustees to preserve contingent remainders during the life of A, only differs from such last-mentioned limitation in not containing any limitation upon the event of A's death. But a limitation to the trustees upon the event of A's death is unnecessary for the purpose of giving a vested remainder, because the estate limited to the trustees determines with A's life. There is therefore no contingent event upon which the estate to the trustees during the life of A is limited, but it is limited in all events, that is, unconditionally, and therefore it is not a contingent remainder.

A difficulty arises from the form of the words in which the limitation is made, for the estate is limited upon the determination, &c. of A's estate, and these words apparently express a condition. But these words in themselves are not words of condition, any more than a limitation to A for life, and upon his death to B and his heirs. They merely denote the events on the happening of which the estate is to take effect in possession. The events which are to determine the life estate of A, and upon which the limitation over is made, are not extrinsic events, such as the return of B from Rome. A limitation over on the event of B's returning from Rome would be a conditional limitation to defeat A's life estate. But the events on which A's life estate may determine before his death, are events to which such an estate is incident; and these events may fix its measure, as well as the death of A. The estate to the trustees for the life of A is therefore clearly an estate analogous in its limitation to an estate limited over on the death of A; the only difference being that A's death is an event that must happen, and the forfeiture, &c. are events which may happen. An estate limited over by way of remainder upon the happening of any of all the events by which the previous estate may determine, is clearly not a contingent remainder within any of the four classes defined by Fearne. But the estate to the trustees and their heirs generally, upon the determination of A's estate in his lifetime by forfeiture or otherwise, without adding 'during the life of A,' is clearly conditional; for by the terms of the limitation nothing is limited to the trustees except in the event of A's estate determining in certain ways in which it may determine, and nothing is limited in the event of its determining by his death, an event that must happen. It is not the words, 'upon the determination of A's estate by forfeiture or otherwise in his lifetime,' which make the estate to the trustees and their heirs generally a limitation of a remainder upon a condition; but it is the circumstance of their estate being for a longer period than the life of A, and nothing being limited to them on the event of A's estate determining by his death, which renders the limitation conditional. This kind of contingent remainder is however hardly included in Fearne's first class; and it seems to form a fifth class of contingent remainders.

An estate similar to the estate to trustees to preserve contingent remainder occurs in the ordinary limitations to uses to bar dower in purchase-deeds, where, after the limitation to the purchaser for his life, and before the limitation of the fee, an estate is interposed to a trustee and his heirs during the life of the purchaser: the object being, by the interposition of a vested freehold remainder, to prevent the purchaser from taking such estate as will entitle his wife to dower. The like observations apply to this estate of the trustee to bar dower as to the estate of the trustees to preserve contingent remainders. This further observation applies to both estates: they fail to become estates in possession not from any contingency attached to their limitation either in words or substance, but because the estates themselves expire before or at the same moment with the particular estate, a circumstance which never prevents a remainder from vesting. Thus, a limitation to A for life with remainder to B for life, gives B a vested remainder; and even if the limitation to B were expressly made 'in case he shall survive A,' still the remainder to B would be vested. The reason of this appears to be, that notwithstanding the words of contingency, there is no real contingency attached to the remainder except that of its possible determination before the particular estate. The force of this observation will appear when it is considered that a limitation to A for life with remainder to B and his heirs in case he shall survive A, gives a contingent remainder to B, while, as already observed, a limitation to A for life with remainder to B for life in case he shall survive A, gives a vested remainder to B.

The importance of this subject must be an apology for these remarks. The limitation to the trustees to preserve contingent remainders may, owing to carelessness or other causes, be expressed in terms different from what it ought to be. Thus the limitation might be to the trustees and their heirs upon the determination of A's life estate by forfeiture or otherwise *in his lifetime*, without the words 'during the life of A;' or it might be to the trustees and their heirs upon the determination of A's life estate by forfeiture or otherwise, without the words 'during the life of A.' In the former case the limitation would be contingent; in the latter a vested remainder in fee would pass to the trustees and their heirs: in both cases the object of the settlement might fail to be secured.*

A contingent remainder may intervene between the particular estate and other limitations over, and yet the subsequent limitations may be vested, if made to a person *in esse*, provided the contingent limitation is not in fee simple. The contingent remainder itself may also vest, and then become an estate interposed between the particular estate and the subsequent vested limitations, if the contingency happens during the existence of the particular estate. If in the same conveyance an estate is limited to A for life, followed by a contingent remainder and a subsequent limitation to A and his heirs, or A and the heirs of his body, this last limitation, though executed under the rule in Shelley's case, is still so executed as to allow the contingent remainder to interpose as a vested estate when the contingency happens. A subsequent contingent limitation may vest before a preceding one, but it follows from what has been said that the preceding one is still capable of vesting.

Lands may be so limited as to be subject to a general power of appointment. In such cases, the general power of appointment will not prevent the estates limited in default of appointment from vesting; though the due exercise of the power will divest them.

Certain cases in which a remainder is limited upon a contingency which affects the preceding estate, but does not affect the ulterior limitations, are discussed by Fearne (p. 233). The same section (x.) contains remarks on limitation which seem to import a contingency, but in fact only denote the time when the remainder is to vest in possession. These remarks seem to be applicable to the case of the trustees to preserve contingent remainders to whom an estate is limited during the life of the tenant for life, though this application of them is not made by Fearne.

A contingent remainder may be limited generally upon any event, except in such cases as the following:—the contingent event being illegal; the remote possibility of the contingent event; and the condition enuring to defeat the preceding estate. These subjects are fully discussed by Fearne (c. 2).

It will be collected from what has been said that a contingent remainder of freehold must be preceded by a vested estate of freehold; for if there is no precedent vested estate of freehold, and the freehold remainder is contingent, the freehold either remains in the grantor, and therefore is not transferred to any one else, or it is transferred in some remainder which is limited after the contingent remainder, and which, being therefore vested in possession, precludes all possibility of the vesting of the contingent estate, which by the terms of the limitation must precede it. This rule as to the necessity of a vested freehold estate to support a contingent remainder, applies both to limitations of uses and of estates limited at common law. If the contingent remainder be for years, there is no necessity for a preceding freehold estate to support it: and when the legal estate is vested in trustees in trust, such legal estate in the trustees renders it unnecessary that a contingent remainder should vest during the continuance or at the expiration of the preceding limitation in trust.

It will also appear from the definitions of contingent remainders that they must vest, that is, the conditions on which they are limited must be fulfilled, during the continuance of the particular estate or immediately on its determination. One of the cases in which such remainders were formerly liable to fail under the fourth class of contingent remainders, was in the case of such limitations as to A for life, and to his first and other sons in tail. Originally a posthumous son could not take, but such child is now for this and several other purposes considered as a person *in esse* during the period of pregnancy. When a contingent remainder is limited to several in a conveyance to uses or by a devise, such remainder will vest in the first person in whom it can vest, but it will divest in due proportions in favour of other persons who are included in the limitations, and who become capable of taking before the determination of the particular estate; and such persons may take as joint tenants, though their estates vest at different times.

Any determination of the particular estate before a legal remainder vests, must, consistently with what has been said, destroy the contingent remainder. The contingent remainder may fail not only through the contingency not happening till after the expiration of the particular estate, but through its destruction by the surrender of the tenant for life, or by the forfeiture of his estate during the existence of the contingency. The intermediate contingent remainder will also be destroyed if the particular estate and the next vested estate of freehold become united by the conveyance or act of the parties, so that the particular estate be merged. This however is not the case when the particular estate with a contingent remainder over and the inheritance are limited by the same instrument, for though the estate in the inheritance is executed, this does not prevent the contingent remainder from vesting upon the happening of the condition on which it depends.

A contingent remainder of an estate of inheritance is descendible to the heirs of an ascertained person to whom it is limited, if such person should die before the contingency happens, and it will vest if the same should happen during the continuance of the particular estate. Contingent remainders were once not considered devisable, but it was afterwards determined that they were devisable whenever they were descendible to the heirs of the persons to whom they were limited; and under the recent statute (1 Vic., c. 26), they are devisable in common with all contingent, executory, or other future interests in any real or personal estate.

Contingent remainders are not assignable at law, though capable of being bound by a contract in equity. They were also capable of being bound by a fine by way of estoppel. By the Irish Act for the abolition of fines and recoveries there is a provision for the assignment at law of contingent estates. There is no corresponding provision in the English act; and as fines are abolished, and a contingent estate is confessedly incapable of being dealt with at law, and a married woman is incapable of contracting, a doubt (perhaps not well founded) exists whether a deed acknowledged by a married woman will bind her contingent remainder even in equity.

Though a fee cannot be limited after a fee as a remainder, two or more contingent fees may be limited in the alternative so that one only shall take effect.

Interests in chattels real and personal are susceptible of limitations over after the limitation of some partial interest in them; but from the nature of those interests they are incapable of such extensive modifications as freehold interests in land, and they cannot be operated upon by the Statute of Uses. Originally a bequest of a term of years to a man for his life was an absolute gift of the whole term, and the donee might dispose of the whole interest as he pleased; but at present a bequest of such term to A for life, and after his death to B, is a bequest of the whole term to A, subject to an executory bequest to B, to take effect if A dies before the expiration of the term. It is not a particular estate to A for life and a remainder to B. Any disposition of a chattel, which in the case of lands would make an estate tail, gives the whole interest. Thus if the second bequest of the term of years were to B and the heirs of his body, B would take the whole interest.

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* For this suggestion as to the nature of the estate limited to the trustees and their heirs without the words 'during the life of A,' and for other valuable remarks, the writer is indebted to a learned friend.

An executory devise is such a limitation of a future estate in lands, and an executory bequest is such a limitation of a future interest in chattels, as are allowed in the case of a will, though not in conveyances at common law. Accordingly a fee may be limited after a fee in a will or by way of use upon contingencies which may happen within certain limits of time; and such limitations take effect as executory devises or springing or shifting uses. But when future estates, are so limited by devise as to be comprehended within the rules which apply to contingent remainders, they will be considered as such, and not as executory devises.

The subject of contingent remainders is fully discussed in the elaborate Essay of Fearne on *Contingent Remainders and Executory Devises;* see also Hayes, *On Conveyancing*, Appendix.)

REMAINS, ORGANIC. [ORGANIC REMAINS.]

REMBRANDT, PAUL GERRETZ, commonly called Rembrandt van Ryn, or Rhyn, was the son of Hermann Gerretz, a miller. He was born in 1606, in his father's mill on the banks of the Rhine near Leyden, whence the agnomen van Ryn. When very young he was sent to a Latin school at Leyden, but he showed such a distaste for learning, that his father gave up the idea of making a scholar of him, and consented to his becoming a painter, as he had manifested a decided talent for it. Young Rembrandt was accordingly placed first with Jacob van Zwaanenburg, or, according to another account, George Schooten. He remained with his first master about three years. He then studied for a short time under Peter Lastmann at Amsterdam, and lastly, for a short time, under Jacob Pinas. From these masters Rembrandt could have learnt nothing more than the mere mechanical part of his art, for both his taste and his style were peculiarly his own. After leaving Pinas, he returned to his father's mill, where he commenced painting, taking the immediate vicinity and the peasants of the neighbourhood as his standard of nature, and applying himself enthusiastically to his work. He had not finished many pieces before he was considered as a prodigy by his friends, and he was persuaded by them to take one of these early productions to a dealer in the Hague, who, to his no greater joy than astonishment, gave him 100 florins (about eight guineas) for his performance. Rembrandt was so elated with this unexpected good fortune, that he posted home to his father in a chariot, to convey the joyful intelligence. From this time he rapidly acquired both fame and fortune. In 1630 he settled in Amsterdam, where he resided the remainder of his life, and shortly afterwards married a handsome peasant-girl of Ramsdorf, whose portrait he has often painted. His reputation now became so great that he had many scholars, each of whom paid him annually 100 florins, and he so arranged their studies as to make them as profitable as possible to himself; he retouched the copies which they made from his own works, and sold them as originals.

This rapid and unexpected good fortune appears to have engendered in Rembrandt a love of money, and avarice became his ruling passion: he resorted to various mean expedients for acquiring wealth; he sold impressions of his etchings, which were the principal source of his income, before they were finished, when finished, and afterwards with slight alterations; and such was the rage after his works, that collectors thought it incumbent upon them to possess impressions of his various etchings in all their different stages, and he is said to have thrown off from some plates even as many as seven proofs, all varying but very slightly. He also circulated reports that he was going to leave the country, and thus created large demands for his etchings. Various other much more absurd and not less mean practices are reported of him; they were worthy of the low taste of Rembrandt, for he could endure no restraint upon his manners or his conversation; polite society was to him intolerable, and he always avoided it.

The burgomaster Six was the only man of rank with whom Rembrandt associated, and with him he occasionally passed a few days in his house in the vicinity of Amsterdam, in which the burgomaster had fitted up a painting-room for him. The history of the celebrated print, the landscape De la Moutarde, which was etched in this house, is curious. Rembrandt could not relish his boiled beef without mustard, but it happened upon one occasion that there was none in the house; and the burgomaster, desirous of pleasing his guest, immediately sent off one of his servants in haste to the city to procure some. Rembrandt, observing that he was rather a phlegmatic-looking person, offered to bet that he would make an etching before the man returned. The wager was immediately accepted, and Rembrandt forthwith, having taken a prepared plate, commenced to etch the landscape from the burgomaster's window, comprising a view of Amsterdam, which he finished in his happiest style with that vigour and lightness of touch peculiar to him, just before the servant arrived with the mustard; hence it was called the landscape De la Moutarde. Although it is little more than a mere foreground, an original impression from this plate is worth from thirty to forty guineas.

According to Saudrart, Rembrandt realised an annual income of nearly 2500 florins (about 200*l.*) from the sale of the copies made from his works by his pupils, and the traffic in his etchings alone, independent of the labours of his own pencil and his pupils' fees; a large amount of itself, but which added to the rest must have made a princely income for those times. He considered that he conferred a favour which he disposed of impressions of some of his plates. The celebrated print of Christ healing the Sick, commonly called the Hundred Guilders, received its denomination from the fact that he refused to sell it for less than that amount—about eight guineas. This plate was bought by Alderman Boydell, who destroyed it after he had taken a few impressions from it, which enhanced the value of the prints accordingly. A good impression is worth from fifty to sixty guineas.

Rembrandt's best etchings realise enormous prices, both the portraits and the historical pieces varying from thirty to a hundred guineas. The most remarkable portraits are those of the burgomaster Six; Van Coppenol, the writing-master; Van Thol, the advocate; Uytenbogaert, the minister, and Uytenbogaert, the gold-weigher.

Rembrandt's great power was portrait; his pictures of that class are in the mass incomparably superior to his historical pieces. The evident cause of this was his utter want of taste in design, which, with rare exceptions, is decidedly the most vulgar of any artist's who has ever earned himself a name. Instead of acquiring fame in the ordinary way by any merits or beauties of form, Rembrandt commanded it, in spite of drawing the most gross and incorrect, through a rich and brilliant colouring, a consummate mastery of chiaroscuro, and not unfrequently a power of composition that has seldom been surpassed. He was, as Fuseli has remarked, 'a genius of the first class in whatever relates not to form. In spite of the most portentous deformity, and without considering the spell of his chiaroscuro, such were his powers of nature, such the grandeur, pathos, or simplicity of his composition, from the most elevated or extensive arrangement to the meanest and most homely, that the best cultivated eye, the purest sensibility, and the most refined taste dwell on them, equally enthralled. He possessed the full empire of light and shade, and of all the tints that float between them. None ever like Rembrandt knew how to improve an accident into a beauty, or give importance to a trifle.' (*Lecture II.*)

Rembrandt is supposed to have acquired his peculiar taste for a brilliant concentration of light from an appearance that he had been familiar with from his infancy in his father's mill, where a strong beam of light coming from a small and lofty aperture cast on the surrounding objects that peculiar tone which we see so happily illustrated in his pictures. He arranged the light in his own painting-room upon similar principles, and generally fixed a drapery behind his sitter of such colour as he intended to paint the ground.

Rembrandt had a contempt for the antique; and the ordinary cant of connoisseurs about grace, sublimity, and grandeur only excited his ridicule. His antiques, as he used to call them, were some old pieces of armour, unique weapons, curious turbans, and various antiquated articles of dress, which he procured from Polish Jews, and with which he indiscriminately clothed individuals of all nations, antient and modern. He once showed one of his performances to Vandyck, who praised the picture considerably; upon which Rembrandt, with a certain degree of satisfaction and consequence, said, 'Yet I have never been in Italy;' 'That's very evident,' returned Vandyck.

Rembrandt's taste led him to imitate certain effects of nature, and in the truth and power with which he gave these effects, both in his paintings and his etchings, he has seldom been equalled, and never surpassed. The prevailing light of his portraits is that of a brilliant sunset, and a rich golden tone of colouring pervades all his works. His originality is perhaps still more conspicuous in his etchings than in his paintings; he exhibited powers of the etching-needle before unknown; many of his plates are prodigies of chiaroscuro; and there is a softness and reality about them which we look for in vain in the works of other masters. It is said that he made a great secret of his mode of etching, and never allowed any one to see him at work. Most of his more important plates have evident traces of the dry point.

Rembrandt, at the beginning of his career, bestowed great labour on his pictures, and, in the manner of the generality of the Dutch painters, wrought them up to a very high finish. The Woman taken in Adultery, in the National Gallery, is probably his best picture in this style. At a later period of life his whole attention was given to the effect, and his pictures, although still greatly laboured, had the appearance of having been executed with a remarkable freedom and boldness of touch: this is particularly the case with his portraits, some of which have an astonishing body of colour in the lights. When this roughness was objected to by any one, he was in the habit of saying that he was a painter, not a dyer; and when visitors ventured to examine his pictures too closely, he used to tell them that the smell of paint was unwholesome.

Rembrandt died in Amsterdam, 1674. He had one son, Titus, who inherited his property, which, according to Descamps, was considerable. Titus was the pupil of his father, but being Rembrandt's son was the only distinction he ever enjoyed. Original Rembrandts are very valuable; some are estimated at several thousand pounds. They are scattered all over Europe, and this country possesses many; those in the National Gallery are all particularly fine specimens: the Gallery of Dresden also possesses several of his master-pieces.

A complete descriptive catalogue of his works was published by D. Daulby, in Liverpool, 1796; another, by A. Bartsch, in 1797, of Vienna; and a list of the principal of them is given in Bryan's *Dictionary of Painters*. The best notices of Rembrandt are those in the work by Descamps, entitled 'La Vie des Peintres Flamands,' &c., and Fiorillo's 'Geschichte der Zeichnenden Künste in Deutschland und den vereinigten Niederlanden.'

There is a fine collection of Rembrandt's etchings in the British Museum.

REMEMBRANCERS (*rememoratores*), formerly called clerks of the remembrance (37 Edw. III., c. 4), are officers of whom, until recently, there were three in the exchequer, called respectively the king's remembrancer, the lord treasurer's remembrancer, and the remembrancer of first fruits; their duty being to put the lord-treasurer and the barons of the exchequer, who are the judges of that court, in remembrance of such things as are to be called on and done for the king's benefit.

I. The office of the queen's remembrancer has relation to the proceedings of the court of exchequer in the exercise of its original jurisdiction as a court of revenue, and of its incidental jurisdiction as a court of equity, founded upon the fiction that the party seeking for relief upon matters of equity is a debtor and an accountant to the king, who by reason of the withholding of that to which he is equitably entitled, is the less able (quo minus sufficiens existit) to pay his debts to the crown. On the revenue side, the queen's remembrancer enters all the recognizances taken before the barons for any of the queen's debts, for appearances, &c., and he takes all bonds for such debts, and for the due execution of offices, and makes out process for breach of them; he also writes process against the collectors of customs, excise, and other public payments, for their accounts. Informations for intrusion into the queen's lands, and information for debts due to the crown, and on penal statutes, are entered and sued in his office; and he makes the bills of composition on penal laws. Indentures and other evidences which relate to the passing of any lands to or from the king are delivered into his office. At the beginning of Michaelmas term he reads in the court the oath taken by all the officers of the court upon admission. Writs of prerogative and writs of privilege for officers and ministers of the court are made out by him; and commissions of Nisi prius, by her majesty's warrant, on trial of any matters within his office, commissions to find debts due to the crown, and writs of extent awarded in pursuance of 33 Hen. VIII., c. 39, are issued and prosecuted in this office; also general process for the recovery of arrears of taxes and other debts due to the crown, which issue twice a year. All differences as to irregularities in proceedings are determined by the queen's remembrancer, with power to give costs against the party in fault, but subject to an appeal to the court. (5 Rich. II., st. 1, c. 15, 16; 13 and 14 Car. II., c. 21.)

On the equity side of the court the deputy-remembrancer performed till lately the same duties which in the court of chancery are performed by the accountant-general and the masters in chancery, but now the court of exchequer has the assistance of an accountant-general and masters in the exercise of its equitable jurisdiction. Under 57 Geo. III., c. 60, for regulating certain offices in the Court of Exchequer in England, the duties of the office of king's remembrancer, &c. are now discharged in person, and not, as formerly, by deputy. He is bound by a rule of court, 3 Jac. II., to attend the court during its sittings, to answer inquiries respecting the course of proceedings, and to enter the rules and orders of the Court of Exchequer relating to its fiscal or its equitable jurisdiction, and he now executes the duties formerly performed by the lord-treasurer's remembrancer, now abolished by 3 and 4 Wm. IV., c. 99.

II. The lord-treasurer's remembrancer's office was the office principally concerned in matters relating to the landed and casual revenue of the crown. When the king's title was found by an inquest of office, it became the duty of the officer with whom the writ and inquisition remained, to send a transcript into the office, in order to being put in charge for the service of the crown; he issued process for debts to the king, and against sheriffs, escheators, &c. and others who did not account. He took the accounts of all sheriffs, and made the record, whereby it appeared whether sheriffs and other accountants paid their proffers, that is, the balance appearing upon their accounts, due at Easter and Michaelmas, and he made another record showing whether sheriffs and other accountants kept their days prefixed. There were also brought into his office all the accounts of customers, comptrollers, and accountants, which were to be entered on record.

All estreats of fines, issues, and amerciaments, set or imposed in any of the courts at Westminster, or at the assizes or sessions, were certified into his office, and by him delivered to the clerk of the estreats, to make out process on them; and he might issue process for discovery of tenures and all revenue due to the crown by reason thereof, &c. As soon as the estreats came into this office, the parties interested might appear and deny the king's right, upon which the pleadings between the crown and the claimant were carried on in this office according to the course of the common law; and the right was either determined by the court upon demurrer or by verdict of a jury. The pleadings and judgments were entered on rolls called the 'Memoranda' of each year. Those of the reign of Edw. I. were published by Serjeant Maynard, in the first volume of his edition of the Year-Books, amongst which appears a letter from the lieutenant-treasurer and barons to the king, setting out the singular proceeding of the Earl Marshal and the Earl of Hereford, who, on Thursday next before the feast of St. Bartholomew, 25 Edw. III., came into the Exchequer with many others, knights-bannerets and bachelors: 'And the Earl of Hereford said that he was charged to say, on behalf of the Earl Marshal and the others who were there, and by all the commonalty (or community) of the kingdom, as well clerks as lay, that of two things they felt themselves grieved: first, by some grievances, the articles of which they had shown to you, their liege lord; and the other, which they understood was done by us of the Exchequer, without your knowledge, in respect of the levying of the eighth (utigme) and the taking of wools. And they said that in the writs which are issued for the levying of the eighth, it is contained, that earls, barons, knights, and the commonalty of the kingdom have granted the eighth, as they and their ancestors have heretofore done; whereas the said eighth by them and the commonalty never was granted. And he said that *nothing reduces a man to bondage more than being taxed at will*, and that if the eighth were so levied, it would turn to the disherison of them and their heirs. And he said openly, *and all the others afterwards*, that such tallage and such taking of wool *were not sufferable, nor would they in any manner suffer them*. And they prayed us that we should redress these things: whereupon they departed without waiting for any answer. Therefore, sire, be pleased to send us your will upon this matter.' The king answered, from Winchelsey, 'As to this, that they would in no wise suffer the levying of the eighth, we will that you do not omit to proceed in taxing, but in as much as they said that the levying would turn to their disherison, &c., make known to the said earls that, in the taxation of the eighth, if there be any who doubt of such prejudice or disherison, the king shall acquit him by his closed letters, that neither the taxation nor the levy be turned to the bondage of any one, or be drawn in use in times to come; but that the king may aid himself now for his great need, which is so urgent for the salvation of himself and themselves and of all the realm, and to lighten the mischief wherewith they have been long time charged. And that the chancellor shall make letters, &c. for those who doubt, &c. And as to the taking of the wools, that the ordinance made thereof be held, and that it be said everywhere by you and by those who intermeddle therewith, that the king will take nothing but by purchase making satisfaction, and that our intention never was otherwise, nor was the thing otherwise put in use.'

Pleadings in the lord treasurer's remembrancer's office have fallen very much into disuse since the alienation of crown lands and the abolition of military tenures by 12 Car. II., c. 24.

Parties may apply in a summary manner for the indulgence of the Court of Exchequer, which is empowered by privy seal, at the commencement of every reign, to compound or discharge any fines, issues, amerciaments, or recognizances, according to the circumstances of each case; and until the recent statute of 3 & 4 Will. IV., c. 99, such applications passed through this office. By that statute, the office of the lord treasurer's remembrancer was, with the offices connected therewith, abolished. Part of the duties of this office had been previously transferred to other offices, part ceased by the act, and the remainder are performed by the queen's remembrancer.

III. The remembrancer of the First Fruits' office receives the bishop's returns of institutions, takes all compositions and bonds for payment of first fruits and tenths, and makes process against all such persons as do not pay the same. (Cowell, *Report of Select Committee on Finance*, 1798.)

IV. Remembrancer of the City of London. The duties of this officer are those of agent for the corporation in parliament, and at the council and treasury boards. He gives a daily attendance at the houses of parliament during every session, to examine all bills and proceedings of the houses of lords and commons, and to report on such as may be likely to affect the interest or privileges of the city. For this purpose, the officers of both houses of parliament give him facilities of admission and attendance; and, for the purpose of identification by them, he sometimes wears a medal with the arms of the city. In this capacity he has to watch from 100 to 200 bills every year; and there are few years in which the corporation have not at least one bill of their own in progress. His duty is further to take the necessary steps to procure the presentation of all addresses and resolutions of the corporation to the king and queen and all the branches of the royal family: to make copies of the addresses and deliver the same, and to attend the sheriffs, when the appointment is made to receive the address or resolution, and the corporation, when the same is presented: to engross all petitions of the corporation to be presented to either house of parliament: to make and deliver copies, and to attend when the petitions are presented. If the petition be to the House of Lords, the remembrancer, with the sheriffs, waits on some peer of parliament, and requests him to present it. He has to give the city members and the sheriffs notice when petitions are to be presented to the House of Commons; to make applications for obtaining, and, when received, to distribute, the city imposts for duties on wine, an allowance made by the lords of the treasury, the origin of which is not known The earliest entry of its being made is about the year 1680. The sum allowed is 100*l*. 16*s*., which is distributed in different proportions amongst the lord mayor, aldermen, recorder, sheriffs, common-serjeant, chamberlain, town-clerk, remembrancer, and sword-bearer. (*Second Report on Municipal Corporations of England and Wales*, 1837.)

REMIREMONT. [Vosges.]

REMIPES. [Hippa.]

REMO, SAN. [San Remo.]

REMONSTRANTS. [Pelagians.]

REMY, ST., a town in France, in the department of Bouches du Rhône, 10 miles east of Tarascon. This town appears to occupy the site of the Roman town of Glanum, or, more fully, Glanum Livii, mentioned by Pliny, and in the 'Antonine Itinerary' and the Peutinger Table. It derives its modern name from St. Remy, bishop of Reims. [Reims.] The town is situated in a marshy valley, and consists of some narrow streets, with irregularly-built houses. The public square is surrounded by buildings of a better class, and is adorned with a fountain: the town-hall, a good building, lately rebuilt, occupies one side of the square. The parish church has also been lately rebuilt. There are two remarkable Roman remains, a triumphal arch and a mausoleum. The triumphal arch has only one small archway, supported at the corners by square Doric pilasters, the capitals of which are the imposts of the arch. On each front of the structure, on each side of the arch, are two fluted Corinthian columns, which have lost their capitals and a portion of their shafts. In the four intercolumnar spaces are groups, each of two figures, touching the wall; but of the whole eight figures, only two retain their heads. The vault of the arch and the archivault are richly ornamented with foliage and similar ornaments in relief. The date of this monument, and the person to whose honour it was erected, are unknown. The upper part is very much dilapidated, and has been covered in with a stone roof to prevent further decay. The mausoleum is in better preservation it consists of three compartments, resting one upon the other, the whole supported by a square base of masonry, and rising to the height of more than fifty feet. The first compartment is a square of rather smaller dimensions than the base on which it rests: its four faces are adorned with sculptures in relief of human figures as large as life, engaged in combat, of tolerably good design: at the corners of this compartment are square pilasters, with capitals of a very grotesque character. The second compartment is also square, with an open arch on each side: the arches, adorned with ornamental sculpture, rest on pilasters without bases. The angles of this part of the building are supported by fluted pillars, with Corinthian capitals and an ornamented frieze. The third part is circular, and is composed of ten Corinthian columns fluted, with an ornamented frieze, supporting a small dome, so as to present the appearance of a small round temple. In it are two statues, now headless, which may be seen between the columns.

There are some other remains, the ruins of walls and a Roman road. A subterraneous aqueduct extends from near the town in the direction of Arles: it is vaulted, five feet high by two feet wide. Urns; medals of gold, silver, and copper; and inscriptions, have been found in considerable numbers.

The population of the commune of St. Remy was, in 1826, 5367; in 1831, 5464, of whom 3213 were in the town. Some silk is thrown, and trade is carried on in corn and wine. There are two yearly fairs. Marble is quarried in the neighbourhood. The town has a lunatic asylum.

RENAIX (in Flemish, *Ronse*) is a considerable town in the province of West Flanders, in the kingdom of Belgium, 20 miles south by west of Ghent, and 7 miles south of Oudenarde. It is a flourishing place, and (according to Cannabich, 1836) has above 12,000 inhabitants, who carry on extensive manufactures of woollens and hats, and have a great trade in those articles and in linen. The only public buildings of any importance are a magnificent château three churches, and an hospital.

RENAUDOT, EUSE'BIUS, a learned writer on the ecclesiastical history and antiquities of the Eastern church, was born at Paris in 1646. His father was first physician to the dauphin of France (afterwards Louis XIV.). Renaudot was educated at the Jesuits' college, and entered the congregation of the Oratoire, though he did not remain long in it. From his early youth he was particularly inclined to the study of the Oriental languages, but chiefly of the Arabic, Syriac, and Coptic tongues, by means of which he was afterwards enabled to enter so deeply into the origin and history of the Eastern church. He became well known at court, where his vast learning made him much esteemed and admired. In this way he was brought to the notice of Colbert, who, being then desirous of establishing printing-presses for the Oriental languages at Paris, consulted him upon the subject, engaged his services and offered him the reversion of a place in the Royal Library; but that minister having died before his views could be realised, Renaudot was not appointed to the vacant office. He seems however to have been employed by the king in various important negotiations with the governments of England and Spain, his time being so much taken up by these occupations, that, while they lasted, he almost entirely discontinued his favourite studies. In the year 1689 he was made a member of the French Academy, and, three years after, of that of the 'Inscriptions et Belles-Lettres.' In 1700 he accompanied to Rome Cardinal de Noailles, archbishop of Paris, who had become his patron, and he acted as his *conclavista* in the conclave which elected Clement XI. to the papal dignity. While at Rome, Renaudot resumed his favourite studies, and the library of the Vatican furnished him with ample materials for the history of the Eastern church—a subject which he had long in mind, and to which he now devoted his whole attention. In this design he was assisted by the new pope, who persuaded him to remain in Rome several months after the departure of Cardinal de Noailles, and gave him the priory of Frossey in Bretagne. From Rome Renaudot went to Florence, where he was equally well received and entertained by the grand-duke, who caused him to be made a member of the Academy della Crusca. On his return to France, Renaudot devoted himself entirely to letters, and composed a great number of learned dissertations, which are printed in the Memoirs of the Academy. He died in 1720, at the age of 74, greatly regretted by the learned men of his time. His fine and extensive collection of Oriental manuscripts he bequeathed to the abbey of St. Germain des Prés. They remained there until the Revolution, when they were incorporated with the Oriental collection in the Royal Library. Renaudot wrote the following works:—1, A collection of controversial pieces on the celebrated work by Nicole, entitled 'Défense de la Perpetuité de la Foi contre les Monuments authentiques de la Religion des Grecs,' Paris, 1708, 8vo.; 2, 'Historia Patriarcharum Alexandrinorum Jacobitarum,' &c., Paris, 1713, 4to.; 3, 'Liturgiarum Orientalium Collectio,' Paris, 1716, 2 vols. 4to.; 4, 'Antient Account of India and China,' written by two Mohammedan travellers of the ninth century, translated from the Arabic, Paris, 1718, 8vo. This has subsequently been found to be only a translation of part of a geographical and historical work, entitled *Muruju-dh-dhahab wa mádanu-jauhar* (meadows of gold and mines of gems), by the celebrated Masudi, an Arabian writer of the tenth century. 5, 'Gennadii Patriarchæ Constantinopolitani Homiliæ de Eucharistia,' together with other Latin treatises on the same subject, Paris, 1703, 4to.

RENDSBURG is a fortified town of Denmark, in the duchy of Holstein, and the capital of a bailiwick of the same name, the area of which is 290 square miles, and includes five parishes. It is situated in 54° 18′ N. lat. and 9° 40′ E. long., partly on a heath, partly on an island at the mouth of the Eyder, at its junction with the Holstein canal. It consists of three parts, the Old Town built on the above-mentioned island, the New Town on the Holstein bank of the river, and the Crown-work, with the last sluice of the canal, and some warehouses, all on the Schleswig side. It has 4800 inhabitants without the military, who amount to 3500 men. There are two churches, an hospital, a house of correction, a gymnasium, a military academy, a board of trade, and a custom-house. It is the residence of the superintendent-general (a high dignity in the Lutheran church); and the military chest of the duchies of Schleswig, Holstein, and Lüneburg is in the town. The place has manufactures of stockings, pottery, tobacco, and vinegar.

RE'NE' OF ANJOU, born in 1409, was the son of Louis II., duke of Anjou and count of Provence. In 1434 he succeeded his brother Louis III., who died in Calabria while waiting for the succession of Queen Joanna II. of Naples, who had named him her heir. Before this time, Réné had married Isabella of Lorraine. After the death of Queen Joanna II., in 1435, Réné laid claim to the kingdom of Sicily and Naples, but he had a powerful rival in Alfonso of Aragon. [ALFONSO V; JOAN II.] Réné was then a prisoner of the duke of Burgundy, who opposed his succeeding to the inheritance of Lorraine, which he also claimed after the death of the duke, his father-in-law. He sent however his wife Isabella to Naples with her younger son Louis. She was received with acclamations by the old and numerous partisans of the house of Anjou. Alfonso of Aragon was then a prisoner in the hands of Filippo Maria Visconti, duke of Milan; but soon after having recovered his freedom, he repaired to South Italy to dispute the crown of Naples with his rival. In 1438 Réné came to Naples, and a desultory warfare was carried on for three years in the Abruzzo and other provinces of the kingdom. The death of the Condottiere Caldora, Réné's best officer, decided the struggle in favour of Alfonso, who laid siege to Naples, and took it in 1442. Réné escaped on board a Genoese vessel to Provence. He was the last of the dynasty of Anjou who sat on the throne of Naples. In 1445 Réné gave his daughter Margaret in marriage to Henry VI. of England, on which occasion he obtained the restoration of his territories of Anjou and Maine, which were in the possession of the English. Réné now resided sometimes at Angers and occasionally at Aix in Provence, occupying himself with the administration of his territories, and also with the arts of painting, poetry, and agriculture. He wrote several works both in prose and verse, among others one on tournaments, the MS. of which, enriched with drawings, is preserved in the National Library at Paris. In 1449-50 Réné attended King Charles VII. of France in his successful war against the English, after which he returned to his dominions to pursue his favourite occupations. His eldest son John attempted to take Naples from Ferdinand of Aragon, who had succeeded Alfonso, but his enterprise failed. In 1473 Louis XI. of France seized Anjou under some pretence, and Réné retired to Aix in Provence, where he died in 1480 regretted by his subjects, among whom he has retained the enviable appellation of 'le bon Roi Réné,' for he continued to style himself king of Sicily and Jerusalem. He introduced several useful trees and plants into Provence, among others the muscadel grape, and encouraged manufactures of woollens and glass. A 'Précis historique' of his life was published by Boisson de la Salle, Aix, 1820, and a marble statue was raised to his memory in one of the squares of Aix, in 1823. Réné's sons having died before him, he was the last representative of the house of Anjou, and after his death Provence was united to France. Bargemont, Vicomte de Villeneuve, has published 'Histoire de Réné d'Anjou, Roi de Naples, Duc de Lorraine, et Comte de Provence,' Paris, 1825.

RENFREW. [RENFREWSHIRE.]

RENFREWSHIRE, a county in the west of Scotland, bounded on the north by the River Clyde, by which it is separated from Dumbartonshire, on the north-east and east by the county of Lanark, on the south and south-west by the county of Ayr, and on the west by the Frith of Clyde. It includes a small portion on the right or north bank of the Clyde, by which this portion is separated from the rest of the county. Its form is that of an irregular oblong, having its greatest length from the junction of the three shires of Ayr, Lanark, and Renfrew, on the south-east, to the banks of the Frith of Clyde, at the point or headland north of Innerkip, in the north-west, 32 miles; and its greatest breadth at right angles to the length, from the shore of Kilbirnie Loch to Erskine House on the Clyde, 13 miles. It is included between 55° 40′ and 55° 58′ N. lat., and between 4° 14′ and 4° 54′ W. long. (*Map of Scotland* pub. by Soc. for the Diff. of Useful Knowledge.) Its area is given by Playfair (*Description of Scotland*) at 225 square miles, or 144,000 English acres; and by MacCulloch (*Statist. Account of British Empire*) at 227 square miles (2 of them water), or 145,280 acres, of which 1280 are water. In Chambers's 'Gazetteer of Scotland' the area is given at 241 square miles, or 154,240 acres. The population in 1801 was 78,056; in 1811, 92,596; in 1821, 112,175; and in 1831, 133,443; showing an increase, steadily maintained, in 30 years, of 55,387, or above 70 per cent.; and giving (by Playfair's estimation of the area) 593 inhabitants to a square mile, a density of population unequalled by any county in Scotland except Edinburghshire, and in England by any except the metropolitan counties of Middlesex and Surrey, and the great manufacturing county of Lancashire. The greater part of the population is gathered round Paisley, Greenock, and Port Glasgow. Renfrew, the capital, is on the Clyde, in 55° 53′ N. lat. and 4° 22′ W. long.

Surface, Geology, Hydrography, and Communications.—The western part of the county, and the southern border which joins Ayrshire, are hilly; the eastern part, especially along the Clyde, is comparatively flat. The hills on the border of Ayrshire are the loftiest. Dunrod hill, Garveck hill, and Creuch hill are near the western extremity of this border; Queenside, Mistylaw (1240 feet high), the hill of

Staik (higher than Mistylaw), the Fernie Neeze hills, the Lochliboside hills and Neilston Pad (the last two rising from 820 to 900 feet), are near the middle of it; and Balagich (1000 feet high) is near the eastern extremity. Stanley or Stanely Brae (620 feet high) is the extremity of the Fernie Neeze hills, which extend toward the centre of the county. The principal eminence of the Lochliboside hills is called Corkindale Law.

The south eastern part of the county is included in the great coal-district of the west of Scotland. The chief coal-works are at Quarrelton near Johnstone; and at Hurlet and Househill near Paisley: the mines here are very productive. In the coal-works at Hurlet, a bed of shale over the coal has, by combination with sulphuric acid, been converted into alum-slate; and a considerable alum-work, perhaps the largest in Great Britain, has for some time been carried on. Limestone, sandstone, ironstone, granite, and secondary trap-rocks are found in considerable abundance. The hills about Mistylaw and Staik are mostly porphyry, capped with greenstone, which intersects the porphyry in innumerable dykes. Alluvial and diluvial beds are observed along the banks of the Clyde. Good freestone for building is quarried; limestone is also wrought for burning; and the coal and ironstone mines give employment to many persons.

The whole county is included in the basin of the Clyde, the æstuary of which washes a large portion of the border; but the tributaries which drain it are all small, and, with one exception, useless for the purpose of navigation. A stream which bears, in different parts of its course, the names of Rotten Burn, Shaws Burn, and Kipp Water, drains the western part, and joins the æstuary of the Clyde at Innerkip on the west side of the county. In one part of its course it expands into two ponds or lochs, one of them above a mile in length, used as reservoirs for a cut made to supply Greenock with a stream of water for turning the mills on the heights above that town. The central and eastern parts of the county are drained by three streams: the Gryfe, which flows from the westward; the Black Cart, which rises in Ayrshire, expands, at or near its source, into Kilbirnie Loch and Castle Semple Loch, and unites with the Gryfe about 2 miles north-west of Paisley; and the White Cart, or, by way of eminence, 'the Cart,' which rises on or near the eastern boundary, and drains the eastern side of the county, then, passing through Paisley, joins the united stream of the Black Cart and the Gryfe, just above its entrance into the Clyde near Renfrew. The White Cart is made navigable partly by an artificial cut to the Clyde. Although the other streams are not large enough for navigation, they supply moving-power to the mills or other machinery. Fish are not abundant in the White Cart; but in Castle Semple Loch pike and eels are found in great number; this loch is also much frequented by waterfowl. Beside the lochs already noticed, there are some others, but all small. The banks of Castle Semple Loch and Loch Libo are well wooded and picturesque.

The only canal is the Ardrossan, which was designed to open a communication between Glasgow and Ardrossan on the Ayrshire coast. It has never been carried farther than from Glasgow to Johnstone in Renfrewshire, about 11 miles west from Glasgow: it passes Paisley. The breadth of the canal at the surface is 28 feet; the depth 4½ feet: it passes through two tunnels, both at Paisley, and is carried over the White Cart by an aqueduct bridge. The traffic on this canal, which is very great, is carried on by luggage boats for goods, and 'gig boats' for passengers. The traffic may be estimated by the following statement:—

	Passengers.	Tons of Goods.
1831	79,456	48,191
1832	148,516	51,198
1833	240,062	53,194
1834	307,275	57,853
1835	373,290	69,510
1836	423,186	67,305

There is a railway from Paisley to the Clyde at Renfrew three miles and a quarter long. A railway from Glasgow to Paisley and Greenock, almost the whole of which is in this county, and one from Glasgow to Paisley, Johnstone, Irving, and Ayr, partly in this county, are nearly if not quite completed. They have a joint line to Paisley. The main-line of the Glasgow and Ayr railway is open. Some interesting details of these railways are given in the 'Companion to the Almanac' for 1841. Coach and other roads from Glasgow to Port Glasgow and Greenock run, one near the banks of the Clyde through Renfrew, another more inland through Paisley. Roads from Glasgow by Paisley run through the valley of Castle Semple Loch, one to Kilbirnie, Ardrossan, and Saltcoats, the other to Beith, Irving, and Ayr. A more direct road from Glasgow to Irving, and a road from Glasgow to Kilmarnock and Ayr, cross the eastern side of the county. Besides these principal lines of communication, there are less frequented roads crossing the county in every direction.

Climate, Soil, Agriculture.—The hilly parts of the county on the west and south are chiefly devoted to pasture. Scarcely more than half the whole surface of the county is under cultivation. The cultivated part is on the north and north-east, and in the centre; where the soil is most fertile. The uncultivated districts comprehend bleak moors or hills, with comparatively extensive bogs in some parts. Owing to the demand for meat, vegetables, milk, butter, &c., by the large and crowded population of Greenock, Port Glasgow, and Paisley, a large part of the cultivated land is meadow-land or garden-ground. Potatoes usually form part of every rotation of crops: a common rotation is as follows:—1, oats from grass; 2, potatoes or barley; 3, oats sown with red clover or rye-grass seeds; 4, hay; and 5 and 6, pasture: another common rotation consists of—1 and 2, oats; 3, barley; 4 and 5, hay; and 6 to 10, pasture. Dry stone dykes are in use in some parts of the county for fences; but where the soil is better and more under cultivation, hedges are used. Tile-draining and the use of bone-manure are rapidly extending. Dairy farming is very extensively practised. There are some large estates, and more than half the valued rent is of entailed or corporate property, but property in the rest of the county is a good deal subdivided. Farms are middle-sized, and farm houses and buildings of middling character.

Divisions, Towns, &c.—There are fifteen parishes in the county, reckoning Paisley and Greenock each as one; and portions of four others, Beith, Cathcart, Dunlop, and Govan, which are partly in Lanarkshire or Ayrshire. There are four burghs: Renfrew, population in 1831, 2833; Greenock, population 27,571 [GREENOCK]; Paisley, population 57,466 [PAISLEY]; and Port Glasgow, population 5192 [GLASGOW]. The principal villages are Johnstone, Gourock, Eaglesham, Kilbarchan, Lochwinnoch, Pollockshaws, and Neilston.

Renfrew, the shire town, is about 6 miles north-west of Glasgow on the road to Greenock. The Stuart family had their earliest known patrimonial inheritance in this parish. Renfrew was a royal burgh, and with its territory and other possessions was granted by David I. (who reigned A.D. 1124-1153) to Walter, son of Alan, whom he at the same time created steward of his household, or, as it was afterwards called, steward of Scotland, a dignity which became hereditary in the family, whence the name of Stewart or Stuart. By virtue of this grant Renfrew ceased to be a royal burgh, and became a burgh of barony; but when the Stuarts came to the throne, it regained its rank as a royal burgh by grant from Robert III., A.D. 1396. The parish of Renfrew comprehends 3776 acres; mostly under cultivation: the population in 1831 was 2833; of whom 2002 were in the burgh. About one-sixth of the population was agricultural. The number of inhabited houses in 1831 was 268 for the town, or 365 for the whole parish. The town is on the east side of the parish, near the Clyde, and consists of one main street along the Glasgow and Greenock road, and some smaller streets. From the burgh to the Clyde is a short canal, about half a mile long, partly formed in the Paddough Burn, once an arm of the Clyde; along the canal is a commodious quay, and across it is a timber drawbridge. Two bridges, one below the junction of the Black Cart and the Gryfe, the other (Inchinnan bridge) below the junction of the White Cart with the united stream, are on the border of the parish, remote from the town. The church is a cruciform structure, insufficient for the accommodation of the parishioners. There are a town-house, jail, and school-house. The number of prisoners in the gaol does not amount to half a dozen in the year, chiefly debtors; and the period of confinement is commonly short. The manufactures are various: muslin-weaving is by far the most important, and employs about 500 to 600 persons, half weavers, the rest (either women or children) in winding or drawing. Many females are employed in clipping, tambouring, and flowering. There is a considerable bleach-field, employing about

100 persons, chiefly women and children. Starch and draining-tiles are made, malt spirit distilled, and coal-works wrought. The coal-works employ 30 to 40 men or boys in the pits, and many others above ground. A few small vessels carrying coal, manure, &c. on the Clyde, belong to the burgh; but a considerable number of vessels, chiefly laden with grain from Ireland or with dye-stuffs for Paisley, discharge their cargoes here. Potatoes and fish are brought here from the Highlands. There is no regular market: there are three fairs in the year, chiefly for cattle.

The corporation consists of a provost, two bailies, and sixteen councillors; the burgh revenues are estimated at about 1400*l.* or 1500*l.* per annum. A weekly court for the administration of justice is held by the magistrates, and the quarter-sessions for the county are held here, but the sheriff-court is held at Paisley. Renfrew was formerly united with Rutherglen, Glasgow, and Dumbarton in returning a member to Parliament; by the Reform Act it has been connected with Kilmarnock, Rutherglen, Dumbarton, and Port Glasgow. The number of voters in the borough is about 80. The parliamentary boundary is more restricted than the antient burgh limits. The election for the county is held here.

There were in 1836 an endowed burgh grammar-school, and five other weekly schools, attended by about 327 day and 90 evening scholars. About 390 children attended Sabbath-schools, and a youth's class of about 60 was taught by the minister. There were a parish library, a subscription library, and a news-room in the burgh; and an association was being formed for the cultivation of natural history and the useful arts. Most of the Sabbath-schools had juvenile libraries. There were several benefit societies, a Bible society, and one or two other charitable institutions. (*New Statistical Account of Scotland.*)

Johnstone is in the parish of Paisley, about three miles west of Paisley town, and is partly noticed elsewhere. [Paisley.] The village has risen by the introduction of manufactures: it had in 1831 a population of 5617. In the centre is a large square entirely surrounded with houses, and a new square and market-place to the south of this are probably by this time completed. There are several streets lined with substantial houses of two stories, roofed with slate. There are a chapel-of-ease, several dissenting meeting-houses, a subscription library, two news-rooms, and a mechanics' institution and library. There are eleven cotton-mills in the town, and several more in the neighbourhood, beside brass-foundries, iron-foundries, machine-manufactories, and gas-works.

Gourock is a small burgh of barony on the Frith of Clyde, about three miles below Greenock, in the parish of Innerkip. Its regular inhabitants are chiefly fishermen; and it is said that this was the first place in Great Britain in which red herrings were cured. There is a ropewalk. Gourock is resorted to in the season as a bathing-place. It has a neat chapel-of-ease. The population of Innerkip parish in 1831 was 2088, about one-fourth agricultural. Innerskip is also resorted to by bathers.

Eaglesham is near the south-eastern extremity of the county, nine miles south of Glasgow. It is a neat village, rebuilt in 1769 by the Earl of Eglintoun, and consists of two rows of houses, 200 yards apart; the intermediate space, through which a rivulet flows, is chiefly used as a bleach-green. There is a cotton-mill in the village, which employs many hands: there are others in the parish. Lawn is woven here. There is a market, and there are four yearly fairs. The church of Eaglesham was built A.D. 1790, by the Earl of Eglintoun; and there is a Secession meeting-house. The population of the parish in 1831 was 2372.

Kilbarchan is a mile and a half west of Johnstone. The houses are mostly of freestone quarried in the neighbourhood. The inhabitants are chiefly engaged in cotton and silk weaving; and the young women are expert in tambouring, embroidering, and flowering muslin. Kilbarchan has a parish church, several meeting-houses, two public libraries, and an agricultural society. There are two other thriving villages in the parish, called the Brig o' Weir (or Bridge of Weir) and Linwood. The population of Kilbarchan parish in 1831 was 4806.

Lochwinnoch is near the western bank of Castle Semple Loch. It is a large village; the houses are generally of two stories, and slated; cotton-spinning is the chief branch of manufacture; but muslin-weaving, wool carding and spinning, and the manufacture of Angola shawls, Canton crapes, and other fabrics are carried on. There are a large parish church and a Secession meeting-house. There are three libraries, two parochial and one other, besides a library for the children attending the Sunday-schools, and several book-clubs. There are three yearly fairs at Lochwinnoch. Population of the parish, in 1831, 4515.

Pollockshaws is in Eastwood parish, about three miles from Glasgow. It is a tolerably large place, consisting of several streets, in a pleasant situation. It has a town-house with a tower and clock, a church rebuilt in 1781, and two places of worship for Seceders, and a small prison or lock-up house. The place depends almost entirely on the cotton manufacture; spinning, weaving, bleaching, and printing are actively carried on. This place was made a burgh of barony by a grant from the crown. There were five schools in the parish in 1836, attended by about 600 day or evening scholars. There are several benefit societies. Coal and stone are procured in various parts of the parish. The population of Pollockshaws in 1831 was 4627; of the whole of Eastwood parish, 6854.

Neilston is nine miles from Glasgow, on the road to Irvine. The population of the village is nearly 2000; that of the whole parish, in which there are some other large villages, was, in 1831, 8046. Cotton-mills, print-fields, and bleach-fields are numerous; freestone and whinstone are quarried, and coal is dug in the parish. The church of Neilston contains some remains of antient Gothic architecture. There is a Secession meeting-house. Five fairs are held in the parish yearly.

The cotton-manufacture is also carried on to some extent in the parishes of Houston, Killellan, and Mearns.

Ecclesiastical and Legal Arrangements.—Of the nineteen parishes which are wholly or partly in Renfrewshire, two, viz. Beith and Dunlop, are in the presbytery of Irvine; three others, Cathcart, Govan, and Eaglesham, in the presbytery of Glasgow; and the rest in the presbytery of Paisley. These presbyteries are all under the synod of Glasgow and Ayr.

The quarter-sessions for the county are held at Renfrew, also the meetings of the commissioners of supply, and the court of election for the member of parliament for the county; but in case of an adjournment of any of these courts, they are generally transferred to Paisley. The sheriff-court for the county was held at Paisley before the appointment of a second sheriff-substitute, since which time two sheriffs' courts have been held for the two divisions of the county, one at Paisley, the other at Greenock. There are a gaol and a house of correction or bridewell for the county and the burgh of Paisley, in one building, at Paisley. It is a substantial edifice, containing in all 77 cells or rooms, viz. 43 in the bridewell, and 34 in the gaol; the discipline of the bridewell was reported by the Inspectors of Prisons, in their Second Report (in Dec., 1836), to be very good, that of the gaol to be very bad; but a later Report, the fourth (Nov., 1838), speaks of considerable improvement. There are small burgh prisons for debtors and criminals at Renfrew, Greenock, and Port Glasgow, and a lock-up-house at Pollockshaws. Several new prisons are required. 'There appears to be much crime in this county: the offences consisting chiefly of thefts and assaults. Housebreaking also is common, though seldom or never accompanied by personal violence. It is stated that there has been a great decrease of murders and highway robberies within the last thirty years; but it is said that the number of petty thefts has increased, and that beyond the increase of population. The places most distinguished for crime in Renfrewshire are reported to be Paisley, Greenock, Neilston, and Pollockshaws. Most of the offenders are said to be from ten to twenty years old. Drunkenness is looked upon as being the chief cause of crime in this county. The procurator fiscal at Greenock having taken twenty cases indiscriminately, and examined into their origin, found that nineteen of them arose from whiskey. Many of the offenders have no knowledge of a trade, and many of their parents are known to be of bad character. The offenders are generally found to be ill educated—more so than others in the same rank of life. Indeed in this respect they appear to be inferior to their predecessors thirty years ago; for the sheriff-substitute of Paisley states that at that period more came before him who could write than now. This want of education is particularly noticed among the Irish, who constitute a considerable portion of the offenders, and whose number in the county has greatly increased of late years, a fact which probably explains the apparent falling off in education among the poorest class.' (*Third Report of the Inspectors of Prisons*, Dec., 1837.) 'There is great want of a good police in the county.' (*Ibid.*)

The county returns one member, who is elected at Renfrew. Paisley and Greenock return one member each; and Renfrew and Port Glasgow unite with Dumbarton, Rutherglen, and Kilmarnock to return another.

The county included, in 1833-34, 19 parochial schools, with 22 instructors, attended by a number of children varying from 656 (viz. 419 boys and 237 girls) to 925 (viz. 577 boys and 348 girls); and 169 schools not parochial, with 193 instructors, and a number of children varying from 5129 (viz. 2965 boys and 2164 girls) to 9747 (viz. 5676 boys and 4071 girls); no other children than those receiving daily instruction are included in the foregoing summary.

History, Antiquities, &c.—In the earliest historical period this county seems to have formed part of the territory of the Damnii, who occupied portions of the adjacent counties of Ayr, Lanark, Stirling, and Dumbarton. Under the Romans it was comprehended in the province of Valentia; and a Roman town or post (Vanduaria) is fixed by some at Renfrew, but more commonly at or near Paisley. It appears to have been subsequently included in the British kingdom of Strathclyde, and afterwards in the kingdom of Scotland. A large part of it came into the hands of the Stewards of Scotland, progenitors of the Stuart family, by grant from the Scottish kings or by other means, especially Strath-Gryfe, or the valley of the Gryfe. A body of the Renfrew men, called, from the Lavern or Levern, a feeder of the White Cart, *Laverani*, were present at the battle of the Standard, in the reign of David I., A.D. 1138. In a later period Renfrewshire made part of the principality formed out of the Stuart domains as an apanage for the eldest sons of the kings of Scotland; in consequence of which arrangement, the district, which was previously under the sheriff of Lanark, was formed into a separate county. Renfrew still gives the title of baron to the eldest son of the reigning king.

Of those antient times Renfrewshire contains a few memorials. Paisley abbey is noticed elsewhere. [PAISLEY.] There are some antient camps. Some antiquities, supposed to be druidical, exist in the parishes of Kilbarchan and Lochwinnoch; but they are of little moment. Barr Castle and Elliston Castle, both in Lochwinnoch parish, Peel Castle on Castle Semple Loch, and Newark Castle near Port Glasgow, belong to the middle ages. Elliston is said to have belonged to the progenitors of Wallace, and popular tradition connects some of the exploits of that hero with localities in Renfrewshire.

The battle of Langside, in which the Regent Murray [MURRAY, JAMES STUART, EARL OF] defeated the last attempt of Mary Queen of Scots to regain her throne, was fought just within the eastern border of the county. The battle of Muirdykes, in which those who supported the attempt of the Duke of Argyle in 1785 (contemporaneous with that of the Duke of Monmouth in the west of England) were defeated, was fought in Lochwinnoch parish in this county.

(*New Statistical Account of Scotland*; Playfair's *Description of Scotland*; Forsyth's *Beauties of Scotland*; Chambers's *Gazetteer of Scotland*; MacCulloch's *Statistical Account of the British Empire*; *Parliamentary Papers*.)

RENI, GUIDO. [GUIDO RENI.]

RENNELL, JAMES, born near Chudleigh in Devonshire, in 1742, entered the navy at an early age as a midshipman. His father was a captain in the artillery. Young Rennell went with Admiral Parker to India, and rendered some effectual service at the siege of Pondicherry. At the age of twenty-four he quitted the navy, and entered the corps of engineers in the service of the East India Company. He distinguished himself in the campaigns of Lord Clive, received some severe wounds, and was promoted to a majority. It was during this period that he produced his first work, 'A Chart of the Bank and Currents of Cape Agulhas,' the most southern point of Africa. While he was stationed in Southern India, he surveyed Adam's Bridge and the Paumbeen Passage between the island of Ramisseram and the continent, and he expressed his conviction of the practicability of widening the passage for ships. This suggestion has been lately acted upon, after a lapse of seventy years. While he held the appointment of surveyor-general of Bengal, he published his 'Bengal Atlas,' with an account of the Ganges and the Brahmapootra, in which he conjectured that the Sampoo of Tibet was the main feeder of the latter river. [BRAHMAPOOTRA.] On his return to England, in 1782, Major Rennell published a map of Hindustan, accompanied by a Memoir, 4to., 1788. He was also elected member of the Royal Society, and became intimate with Dr. Vincent, Sir Wm. Jones, Dr. Horsley, bishop of St. Asaph, and other learned men of his time. In 1793 he published 'Marches of the British Army in the Peninsula of India during the Campaigns of 1791.' He also published 'Memoir of a Map of the Peninsula of India, exhibiting its Natural and Political Divisions, the latter conformably to the Treaty of Seringapatam, of March, 1792;' and also 'Elucidations of African Geography, from the Communications of Major Houghton and Mr. Magra, in 1791, with a Map.' In 1794, Major Rennell published a political pamphlet, entitled 'War with France the only Security of Great Britain at the present momentous crisis, by an Old Englishman.' The French Convention had already placed themselves out of the pale of international law by their resolutions of the 19th of November, 1792, in which they offered their aid to any people in any country of Europe who wished to overthrow the existing government. In 1798 he assisted Mungo Park in the arrangement of his African travels, and illustrated his work by a map and a memoir in the appendix. His next work, and that by which he is most generally known, was 'The Geographical System of Herodotus examined and explained,' 4to., 1800. He also wrote:—1, 'Observations on the Topography of the Plain of Troy;' 2, 'A Treatise on the Comparative Geography of Western Asia,' with an Atlas, a work of great labour and research; 3, 'Illustrations, chiefly Geographical, of the History of the Expedition of the younger Cyrus from Sardis to Babylon, and the Retreat of the Ten Thousand;' 4, 'An Investigation of the Currents of the Atlantic Ocean, and of those which prevail between the Indian Ocean and the Atlantic.' For this important work he examined and collated the log-books of all the ships of war and Indiamen which had traversed those seas during the last thirty or forty years, re-computing their observations and reducing them to one general system. The results of all this prodigious labour were ready for the press at the time of his death, and were shortly afterwards published by his daughter, Lady Rodd, in several large charts, showing by an infinite number of arrows the direction and force of the currents throughout the Atlantic ocean, and accompanied by a thin volume which ought to be studied by every seafaring person. Major Rennell also wrote some papers in the Transactions of the Royal and Antiquarian Societies, such as a Disquisition on the Melita Island of St. Paul's voyage; the place of Julius Cæsar's landing in Britain, in which he proves that the principal mouth of the Thames was then to the southward of the Isle of Thanet, &c. Major Rennell died on the 29th of March, 1830; and on the 6th of the following April his remains were interred in Westminster Abbey, where a tablet with an appropriate inscription is placed over his tomb. Biographical notices of him were inserted in the periodicals of the time, in which both his public and his private character were spoken of in those terms of praise which he justly deserved.

The merits of Major Rennell as a laborious investigator and an acute critic are universally acknowledged. Love of truth, patient and persevering research, and sound judgment are eminently displayed in all that he did. It is a matter of surprise, with the limited means at his command, that he accomplished so much in the department of comparative geography; and though we are now enabled, by new discoveries, to rectify many of his conclusions, the results to which he did attain will always remain as evidence of his unrivalled sagacity. His 'Geographical System of Herodotus' is a monument worthy of the writer whom he illustrated. Though unacquainted with the Greek language, and obliged to trust to the very inaccurate version of Beloe, he succeeded in producing a commentary on a classical author which is not surpassed by the labour of any scholar. The blundering of Beloe, and his occasional complete perversion of the original, did not mislead the geographer, who could detect the author's meaning, even under the disguise of the translation. (*Journal of Education*, vol. i., p. 330, &c.) As a geographer, Major Rennell was one of the first Englishmen who has earned any permanent reputation; and in illustrating Herodotus and the Retreat of the Ten Thousand, he occupies a place by the side of D'Anville.

RENNES, a town in France, capital of the department of Ille et Vilaine, 186 miles in a direct line west by south of Paris, or 215 miles by the road through Versailles, Dreux, Alençon, Mayenne, and Laval, in [illegible] W. long.

This town, at the time of the Roman conquest, bore the name of [illegible]. It is [illegible] by Ptolemy as the chief town of the Redones, a Celtic tribe, and is also mentioned in the Itinerary of Antoninus and the Table of Peutinger. At a later period it took the name of the people to whom it belonged, Redones, from which is derived the modern name of Rennes. In the ninth century, when the kingdom of Bretagne was restored by Nomenoé ([illegible]), Rennes was taken by that prince, and either then or some time afterwards became capital of Bretagne. In the anarchy which prevailed in Bretagne towards the close of the ninth century, Rennes was the capital of a county till A.D. 992, when Count Geoffroi of Rennes assumed the title of duke of Bretagne; after which event it became again the capital of all Bretagne. In the struggle between De Montfort and De Blois for the ducal coronet, Rennes, then held by the partisans of De Blois, was besieged for six months by John of Gaunt, duke of Lancaster, but he was obliged to raise the siege. Before the Revolution the states of Bretagne met at Rennes, and it was the seat of a parliament instituted A.D. 1555, by Henri II.

In 1720 the town of Rennes was laid waste by a fire, which lasted from the 22nd to the 29th of December, and consumed twenty-seven streets, five squares, and eight hundred and fifty houses in the very heart of the place. The new part, rebuilt after this catastrophe, forms one-third of the town, or, including the faubourgs or suburbs, one-fifth. It is distinguished by wide and straight streets intersecting at right angles. The town stands in a plain watered by the Vilaine and its tributary the Ille, which unite a little below the town. It is surrounded by an antient wall and towers, and, though of little strength, still ranks as a fortress. The Vilaine divides Rennes into two parts, the upper town on the north bank, and the lower town on the opposite bank, which are united by three bridges. The lower town, which is the smaller, is built on a low flat site, frequently inundated, and has narrow and crooked streets, with houses mostly built of wood, curiously carved and highly picturesque. The faubourgs or suburbs, which are large, resemble the lower town in character. The upper town is between the Vilaine and the Ille, on a site little more raised than the lower town; it comprehends the new quarter, and has well-paved streets, large squares or 'places,' and generally lofty well-built houses. Vaysse de Villiers however speaks of the place as dull and gloomy, characteristics which may be partly ascribed to the sombre tint of the granite or sandstone of which the houses are built, and partly to the dulness of the climate, the flatness of the surrounding country, and the sluggish and muddy current of the Vilaine. The principal 'places' or squares are La Place du Palais, so called from the Palais de Justice, which forms the north side of it, and La Place d'Armes, or Parade, larger than La Place du Palais, but not so handsome. There are several public walks: that of La Motte, which separates the Faubourg de Paris from the town; the promenade on the quay of the Vilaine, nearly a mile in length; the Champ de Mars; and Le Mail · the last just at the junction of the Ille and the Vilaine.

The cathedral is a heavy and ugly Gothic structure; a new cathedral, dedicated to St. Pierre (Peter), was commenced after the great fire of 1720, but, according to our latest authorities, is not yet finished. The two towers of the principal front form a conspicuous object in a distant view of the town, but on a closer view by no means answer the expectations excited. Of the other churches, that of St. Sauveur is the handsomest. Le Palais de Justice, or court-house, is a building having a front of the Tuscan order, heavy and ill-proportioned; the other three sides are adorned with Corinthian pilasters. It is appropriated to the administration of justice and to the study of the law, and is decorated with paintings and arabesque ornaments. The Hôtel de Ville (town-hall) is a building of less architectural pretension but more pleasing appearance than the Palais de Justice. Over the central part rises a clock-tower: it contains the rooms for the tribunal of commerce and the public library. Among the other public buildings are the office of the prefect, the episcopal palace, the ex-abbey of St. Georges, now occupied as a barrack, the Hôtel Kergus, antiently a school or college, now a barrack, and the Hôtel Blossac.

The population of the commune of Rennes, in 1826, was 29,377; and in 1831, 29,680, of whom 27,340 were in the town and the immediate suburbs; and, in 1836, 35,552. The manufactures of the place are not extensive, but comprehend a variety of articles; [illegible] linen and cotton [illegible] common linens, [illegible] glue, [illegible] are [illegible] and wax-bleaching houses. A [illegible] considerable trade is carried on in these articles and in the honey, wax, poultry, and butter of the surrounding district. The Vilaine is rendered navigable by locks up to the town, and communicates with the little port of Redon. The canal of the Ille and the Rance communicates with the port of St. Malo, and roads converging at the town communicate with St. Malo, St. Brieuc, Brest, Lorient, Vannes, Redon, Nantes, and other places on or near the coast of Bretagne. There is a fair on the 1st of each month.

Rennes is the seat of a bishopric, comprehending the department in its diocese; the bishop is a suffragan of the archbishop of Tours. It has a Cour Royale, or court of justice, and an Académie Universitaire, the jurisdiction of which extends over the five departments of Ille et Vilaine, Côtes du Nord, Finistère, Morbihan, and Loire Inférieure; and it is the head quarters of the thirteenth military division, which includes the same departments except Loire Inférieure. There are a number of fiscal or administrative government offices; a prison or house of correction for the department, subject to the jurisdiction of the Cour Royale; an arsenal, an artillery forge, royal schools for artillery and riding, and several other military establishments. The educational establishments are important. There are a law-school, a secondary school of medicine, a high school or college, two seminaries for the priesthood, some schools of mutual instruction, a society of arts and sciences, and a school of painting. The public library was formed a century ago by a body of advocates, and augmented by the spoils of the monasteries plundered at the Revolution: it now contains 30,000 well-chosen volumes, including some of the rarest and earliest editions of the antient classics, and some valuable MSS. There is a small well-chosen cabinet of paintings; and there are cabinets of physics, natural history, antiquities, and medals; a botanic garden, and a theatre. There are several churches, four hospitals, a maternity society, and several public baths.

Among the eminent natives of Rennes are the Benedictine Lobineau, who died A.D. 1721, author of a well-known history of Bretagne, and, in conjunction with Felibien, of a history of Paris; Tournemine, the Jesuit, who died A.D. 1739, author of a history of the Jews; L'Abbé de la Bletterie, who died A.D. 1772, author of a history of the Roman emperor Julian, and translator of Tacitus; several eminent lawyers, the engineer Vauban, and the count Lanjuinais.

The arrondissement of Rennes has an area of 528 square miles, and comprehends 78 communes. The population, in 1831, was 126,375; in 1836, 130,838. It is divided into ten cantons or districts, each under a justice of the peace.

RENNIE, JOHN, was a native of Scotland, and born on the 7th of June, 1761, at Phantassie in Haddingtonshire, where his father was a respectable farmer. He acquired the rudiments of education at the school of the place, and afterwards received instruction in the elementary part of mathematics at Dunbar, where, on the promotion of the master, he for a short time conducted the school.

It does not appear that Rennie pursued his studies far in pure mathematics, but his taste leading him to contemplate the nature and properties of machines, he probably applied himself chiefly to those parts of science which relate to elementary mechanics, and it is certain that he made himself a proficient in the useful art of drawing machinery and the different objects which belong to practical architecture. He also took advantage of such opportunities as his avocations afforded to attend the courses of lectures on mechanical philosophy and chemistry which were then given at Edinburgh by Drs. Robison and Black. Prepared thus with what books and professors could teach, he entered the world; and it may be said that, during all the course of his useful life, he was adding to his stock of knowledge, or seeking the means of improving his practice by observing the operations and effects of his own works, as well as of those which were executed by other men.

Mr. Rennie was employed for a time as a workman by Mr. Andrew Meikle, a mechanist of his native parish, under whose superintendence he assisted in the erection of some mills in the neighbourhood; and he is said to have rebuilt, on his own account, one near Dundee. It is probable that soon after this work was finished, or about 17[illegible], Mr. Rennie, feeling himself qualified to practise the profession of civil engineering on a greater scale than his own country at that time afforded, set out for London. On his way he visited the docks at Liverpool, and spent some months at Soho near Birmingham, in examining the works of Messrs. Boulton and Watt, to whom he had brought letters of introduction from the professors at Edinburgh.

Soon after he was established in the metropolis, Mr. Rennie was employed by those gentlemen in the construction of two steam-engines and the machinery connected with them, at the Albion Flour-Mills near Blackfriars Bridge. These steam-engines were of the kind called double, for which Mr. Watt had taken out a patent in 1782; each of them was of 50-horse power, and the two could turn twenty millstones. All the wheel-work was made of cast-iron, instead of wood, which had before been used in such machinery; and the talents of Mr. Rennie were particularly manifested in the methods which he adopted to render the movements steady. The works were finished in 1789; but they continued in operation only during two years, the whole of that great establishment having been unfortunately destroyed by fire in 1791.

Mr. Rennie continued to the last to be employed in the construction of steam-engines, or of the different kinds of machinery to which, as a first mover, steam is applied; and at the same time he was almost constantly engaged in designing or superintending those public works which have given him so just a claim to celebrity. Between 1799 and 1803 he constructed the stone bridge at Kelso, below the junction of the Tweed and Teviot. This work, as elegant in its design as valuable for its utility, consists of five elliptical arches carrying a level roadway, and over each pier are two small columns, which support the entablature. Mr. Rennie also built stone bridges at Musselburgh and other places in Scotland; but his master-piece of this kind is the Waterloo Bridge over the Thames. This bridge, so much distinguished by its grandeur and simplicity, was begun in 1811, and finished in six years. It consists of nine equal elliptical arches, 125 feet in span, and the faces of the piers are ornamented with coupled Doric columns. Besides the elegantly designed iron bridge over the Witham in Lincolnshire, he also built that which is called the Trafalgar or Southwark Bridge, over the Thames. The latter consists of three cast-iron arches resting on stone piers [BRIDGE], and the span of the centre arch is 240 feet.

Mr. Rennie superintended the formation of the Grand Western Canal, which extends from the mouth of the Ex to Taunton; and, in conjunction with Mr. Murray, that of the Polbrook Canal between Wade-bridge and Bodmin, in Cornwall. He also superintended the execution of the Aberdeen canal uniting the Don and the Dee, and of that between Arundel and Portsmouth. But his chief work in connection with inland navigation is the Kennet and Avon canal, which extends from Bath to Newbury, and which required all the skill of the engineer to conduct it through the rugged country between those places. He also gave a plan for draining the fens at Witham in Lincolnshire, which was executed in 1812.

The London Docks, and the East and the West India Docks at Blackwall, are among the great works which were executed from the plans and under the direction of Mr. Rennie; and at the last-mentioned docks he constructed the sheds which cover timber and other merchandise; the roofs of these are formed of iron frames covered with slate and supported on iron pillars. He formed the new docks at Hull (where also he constructed the first dredging-machine which was used in this country), the Prince's Dock at Liverpool, and those of Dublin, Greenock, and Leith, of which the last is remarkable for the particularly strong construction of its sea-wall. [DOCK.] To these must be joined the insular pier or breakwater protecting Plymouth Sound from the waves which during high winds used to roll in with tremendous force. [PLYMOUTH.] Mr. Rennie also gave plans for improving the harbours of Berwick, Newhaven, and other places, and the dockyards of Portsmouth, Plymouth, Pembroke, and Chatham: he also built the pier at Holyhead.

Before his death he had given plans for improving the docks at Sheerness; which have since been executed by his first and second sons Messrs. George and John (now Sir John) Rennie: the gates are formed of cast-iron ribs, covered, on the side next to the stream, with cast-iron plates, and on the other side with planks of wood. It should be observed also that Mr. Rennie, sen. gave the designs for the present London Bridge; and that the charge of its construction was confided to Sir John Rennie, who, in 1831, finished that magnificent structure. [BRIDGE.] The span of its centre arch is 150 feet. The same gentleman executed also the light and elegant stone bridge which has replaced the old bridge of timber at Staines.

Mr. Rennie married in 1789, and had six children; four sons and two daughters. He survived his wife, and, till within a few years of his death, he enjoyed excellent health. He died of an inflammation of the liver, October 16, 1821, and was buried in St. Paul's Cathedral.

The sums expended in the construction of Mr. Rennie's bridges have appeared so great as to give rise to an opinion that the measures adopted for the stability of those structures exceeded those which a due regard to economy should warrant. Of this however it is scarcely possible to form a right judgment. It is true that the Waterloo Bridge cost more than a million sterling, but several circumstances contributed to make the expense of that bridge greatly exceed that of the bridges before built over the Thames; it is, in the first place, longer, the material is granite, and the piers were built in cofferdams. Now, granite is more costly than any other species of building-stone, both at the quarry and in the charges for working it into form; and a cofferdam, with the engines necessary to keep out the water, is much more so than a caisson. But in a great public work durability is a primary consideration; and this is ensured by the employment of the best materials and by taking the most effectual means of securing the foundations. The expensive repairs which the bridges at Westminster and Blackfriars have required, and will continue to require, will probably, in the end, afford a full justification of the measures which have been followed in the construction of the Waterloo and the new London bridges. In the execution of machinery, Mr. Rennie may be said to have been the first who made that skilful distribution of the pressures, and gave those just proportions to the several parts, which have rendered the work of Englishmen superior to that of any other people.

We may here observe that the refined theories of the mathematician are too general to admit of being brought down to all the circumstances which depend on the constitution of material substances; and, from the minute division of labour among us, the artisan passing his life in the execution of one particular kind of work is seldom capable of making alterations by which a complex system of machinery might, as a whole, be improved. Therefore neither the profound philosopher nor the industrious operative can, alone, be expected to constitute a complete engineer; and if this character is to be attained, it will probably be found in a man in whom, as in the subject of this article, are united the thinking mind, and, to a certain degree, the labouring hand, and whose duties leave him sufficient leisure to investigate the mutual actions of bodies on one another by appropriate experiments.

RENT, in Political Economy, is defined by Mr. Ricardo to be 'that portion of the produce of the earth which is paid to the landlord for the use of the indestructible powers of the soil. It is often however (he remarks) confounded with the interest and profit of capital, and in popular language the term is applied to whatever is annually paid by a farmer to his landlord.' Mr. Malthus (*Prin. of Pol. Econ.*) defines rent to be 'that portion of the value of the whole produce which remains to the owner of the land, after all the outgoings belonging to its cultivation, of whatever kind, have been paid, including the profits of the capital employed, estimated according to the usual and ordinary rate of the profits of agricultural capital at the time being.' The origin and progress of rent will be subsequently considered.

The chapter on rent, in the 'Wealth of Nations,' though abounding in important facts, is, in respect to the author's conclusions, generally regarded as the most erroneous and defective in that work: it contains no distinct enunciation of the nature and causes of rent, although, it is remarked, he appears in some instances to have contemplated the subject in its true light. Other writers have treated the question in the same way, without more clearly elucidating it. The economists of the school of Quesnay have taken many just views of the nature of rent, but have equally failed in deducing from them the inferences to which they obviously led. Dr. James Anderson [ANDERSON], in the 'Recreations in Agriculture' (vol. v., p. 401), published in

1801, is acknowledged to have propounded the theory of the origin and progressive increase of rent as now generally recognised; but his theory excited little attention at the time; and it was not until 1815 that it was more fully and elaborately treated in two works published simultaneously: one of them was an 'Essay on the Application of Capital to Land,' by a Fellow of University College, Oxford (Mr. West, a barrister, afterwards chief-justice of Bombay); the other work was by the late Mr. Malthus, and was entitled 'An Inquiry into the Nature and Progress of Rent.' The late Mr. Ricardo had adopted the principles of these two works several years before they were published, but it was not until 1817 that a pamphlet by him appeared in which their truth was forcibly and clearly demonstrated. The publication of his 'Principles of Political Economy and Taxation,' in the same year, may be considered as having established all the main points included in the theory of rent. This theory, and that of Mr. Malthus on population, are undoubtedly the most important additions which have been made to the science of political economy since the publication of the 'Wealth of Nations' in 1775. But although the fundamental principles of the theory of rent are now generally considered as settled, there are several subordinate parts of the question on which political economists are at variance. Mr. Mill and Mr. MacCulloch have more fully adopted the Ricardo theory than any other writers; but Mr. Malthus has dissented from some of its principles, although his views in the main coincide with that theory; and Professor Tucker, of the university of Virginia, dissents from it still more widely than Mr. Malthus. Mr. Senior, while condemning some of Mr. Ricardo's reasonings, appears to have again propounded them under a different form.

The causes of the ordinary excess of the price of raw produce above the cost of production, as enumerated by Mr. Malthus, are:—1, That quality of the soil, by which it can be made to yield a greater quantity of the necessaries of life than is required for the maintenance of the persons employed on the land. This is the foundation of rent, and the limit to its possible increase. 2, The second quality consists in that property peculiar to the necessaries of life, by which, if properly distributed, they create demanders in proportion to the quantity of necessaries produced. Thus, the effect is to give a value to the surplus of necessaries, and also to create a demand for more food than can be raised on the richest lands. 3, The comparative scarcity of fertile land; a circumstance which is necessary to separate a portion of the general surplus into the specific form of rent to a landlord. As most modern economists have adopted the main principles of the Ricardo theory, we here give an outline of it, in the words of Mr. Ricardo.

Mr. Ricardo says:—'If all land had the same properties, if it were boundless in quantity and uniform in quality, no charge could be made for its use, unless where it possessed peculiar advantages of situation. It is then because land is of different qualities with respect to its productive powers, and because, in the progress of population, land of an inferior quality, or less advantageously situated, is called into cultivation, that rent is ever paid for the use of it. When, in the progress of society, land of the second degree of fertility is taken into cultivation, rent immediately commences on that of the first quality, and the amount of that rent will depend on the difference in the quality of these two portions of land. . . . With every step in the progress of population which shall oblige a country to have recourse to land of a worse quality to enable it to raise its supply of food, rent on all the more fertile land will rise. . . . If good land existed in a quantity much more abundant than the production of food for an increasing population required, or if capital could be indefinitely employed without a diminished return on the old land, there could be no rise of rent; for rent invariably proceeds from the employment of an additional quantity of labour with a proportionally less return.'

Rent, according to the definition which has been given, consists of a surplus which remains after the capital expended in production has been replaced with ordinary profits. This surplus, which constitutes rent, arises, as Mr. Ricardo asserts, from, and is in proportion to, the necessity for resorting to inferior soils or employing capital on the old soil with smaller returns. To use the words of Mr. Mill, his friend and disciple—'Rent is the difference between the return made to the more productive portions and that which is made to the least productive portion of capital employed upon the land.' In a country containing, as every country does contain, land of various degrees of fertility, rent therefore will not be paid until the demands of an increasing population have rendered it necessary to have recourse to the inferior soils. 'Thus (continues Ricardo), suppose land, Nos. 1, 2, 3, to yield, with an equal employment of capital and labour, a net produce of 100, 90, and 80 quarters of corn. In a new country, where there is an abundance of fertile land compared with the population, and where therefore it is only necessary to cultivate No. 1, the whole net produce will belong to the cultivator, and will be the profits of the stock which he advances. As soon as population had so far increased as to make it necessary to cultivate No. 2, from which 90 quarters only can be obtained after supporting the labourers, rent would commence on No. 1; for either there must be two rates of profit on agriculture, or ten quarters or the value of ten quarters must be withdrawn from the produce of No. 1 for some other purpose. Whether the proprietor of the land or any other person cultivated No. 1, these ten quarters would equally constitute rent; for the cultivator of No. 2 would get the same result with his capital, whether he cultivated No. 1, paying ten quarters for rent, or continued to cultivate No. 2, paying no rent. In the same manner it might be shown, that when No. 3 is brought into cultivation, the rent of No. 2 must be ten quarters, or the value of ten quarters, whilst the rent of No. 1 would rise to twenty quarters. . . It often and indeed commonly happens that before Nos. 2 and 3, or the inferior lands, are cultivated, capital can be employed more productively on those lands which are already in cultivation. . . In such case, capital will be preferably employed on the old land, and will equally create a rent; for rent is always the difference between the produce obtained by the employment of two equal quantities of capital and labour. If with a capital of 1000*l.* a tenant obtain 100 quarters of wheat from his land, and by the employment of a second capital of 1000*l.* he obtain a further return of 85, his landlord would have the power, at the expiration of his lease, of obliging him to pay 15 quarters, or an equivalent value for additional rent; for there cannot be two rates of profit. If he is satisfied with a diminution of 15 quarters in the return for his second 1000*l.*, it is because no employment more profitable can be found for it. . . In this case, as well as in the other, the capital last employed pays no rent. For the greater productive powers of the first 1000*l.*, 15 quarters is paid for rent; for the employment of the second 1000*l.*, no rent whatever is paid. If a third 1000*l.* be employed on the same land, with a return of 75 quarters, rent will then be paid for the second 1000*l.*, and will be equal to the difference between the produce of these two, or 10 quarters; and at the same time the rent of the first 1000*l.* will rise from 15 to 25 quarters, whilst the last 1000*l.* will pay no rent whatever.' (Ricardo's *Prin. of Pol. Econ.*, 3rd ed.) Perhaps however the clearest definition of this theory of rent is that given by Mr. Mill, in his 'Elements of Pol. Econ.,' 3rd ed.

There remains to be noticed another incident of rent, namely, that it does not form a part of the cost of production. Mr. MacCulloch has given the shortest explanation of this law in Note iii. of his edition of the 'Wealth of Nations.' 'The price of raw produce,' he remarks, 'does not exceed the cost of production,' including in that expression the ordinary profits of the producer's capital. 'The aggregate price exceeds the aggregate cost of production; but this is because the cost of production is unequal. The price exceeds the lowest, but not the highest cost of production: and this highest cost, since it regulates the price of the whole, may be considered, without impropriety, as the cost of the whole, and the rent to be a peculiar privilege of favoured individuals.'

The circumstances which precede or accompany the cultivation of inferior lands or the employment of additional capital on the old lands are—1, an increase of population; 2, the accumulation of capital; 3, a rise in the exchangeable value of raw produce. The two first cause a fall in profits and wages, and a rising market-price of raw produce is a consequence of more labour or more capital being required to produce it, or of a deficient supply previous to its being produced. In a new country, the whole produce is divided between the capitalists and labourers, and so long as fertile land is in abundance and may be had for an almost nominal price, nobody will pay a rent to a landlord, and profits and wages are maintained at a high rate. But capital accumulates and wages decrease; and whenever agriculture has reached a state in which the returns of additional capital on the old lands are less than could be obtained from the inferior land, such inferior land will be cultivated, and if the profits of the capital employed on such inferior land were 20 per cent., while the old lands yielded 30 per cent., a rent would arise equivalent to the difference, or 10 per cent. This, as well as any subsequent rise of rents, is caused by more capital being ready to be laid out on the old lands, but which cannot be so employed without diminished returns, and this circumstance renders it more profitable to take fresh lands into cultivation, though of an inferior degree of fertility.

One of Professor Tucker's objections to the Ricardo theory of rent is directed against the assumption that 'the means of subsistence are a fixed quantity, or near it, instead of its admitting of such gradations that a labourer may be supported by one-fifth of the soil once required for subsistence;' and he points to the western states of the American Union, where a labourer can earn in less than ten days as much grain as he can consume in a year, and where consequently a very high scale of diet is maintained, and he contrasts it with other countries in which the whole of the year's labour is necessary to earn subsistence for the year, although the scale of diet is comparatively low. In the Atlantic states of the Union, as compared with the Western states, the contrast is also very striking. This varying character of human subsistence, Professor Tucker contends, may be a cause of rent, without either an increase or decrease in the returns to capital. The very high rents paid in Ireland may be partly attributed to this cause. In the course of his objections to Mr. Ricardo's theory, Professor Tucker remarks:—'Land is a productive machine, which but a few possess, but whose produce none can dispense with, and for which there being more and more demanders, they must and will give more and more of their labour to obtain it. . . Rents, having once begun, continue to increase with the increase of population and the more frugal consumption to which it impels individuals.' Mr. MacCulloch simply regards the adoption of a less costly food by the labourers as similar in its effects upon prices and rents to an improvement in agriculture. Professor Tucker's further objections against the Ricardo theory consist in its ascribing 'the progressive rise of raw produce and of rents to the greater amount of labour expended on the soil last cultivated, and not to the greater cheapness of all labour from the increase of population;' and in its maintaining that 'when raw produce rises, labour also rises' (p. 156). He concludes, 'that neither is a resort to soils of inferior quality, to lands more distant from market, nor different outlays of capital on the same lands, necessary either to the existence of rent, or to its progressive increase, but that it is caused solely by the increase of population, together with the capacity which the same soil possesses of supporting a greater number by reason of their resorting to a more frugal mode of subsistence' (p. 121). It should be observed, that Professor Tucker admits that 'successive resorts to inferior soils, or outlays of fresh capital on old lands, keep pace with the rise of raw produce, and ordinarily afford a *measure of the progress of rent*, and of its different degrees, according to diversities of fertility, culture, or distance from market, but they are not the cause of its rise' (p. 113). Indeed, whatever may be the true theory of the causes and amount of rent in any given community, it may be very easily shown that the existence of soils varying in fertility is not a necessary element to the existence of rent, while the limited amount of productive soil is a necessary element.

Advantages of position, such as a proximity to markets, may counterbalance the disadvantage of barrenness, and land of this description, which, if it were further removed, would yield no rent, will, under these circumstances, produce a higher rent than more fertile lands situated at a distance from the same market. Land in the neighbourhood of towns yields a high rent, and a still higher rent is paid for land in towns. The rent in each of these cases is regulated either by the common principle that there cannot be two rates of profit, of which the case first mentioned is an instance; or, as in the latter examples, it is determined by the limited extent of such land.

Restrictions on the importation of grain, by forcing the inferior soils into cultivation, undoubtedly tend directly to raise rents; but no possible quantity of imported produce could have any material effect in diminishing the total rents of the country. Importation necessarily implies the existence of high prices in the importing country: it has a tendency to equalise rather than to lower prices, as, by facilitating the exchange of manufactured goods for common food, population is increased, and an increased demand arises for other products of the soil besides bread corn. This has been the case in the territory of Genoa, where the soil, though of a sterile nature and unfit for the production of corn, yields a higher rent than the fertile corn-lands in the plains not far distant; for the cost of production being low by means of the low price of imported food, land may be cultivated for various agricultural objects, and yield a rent which, if employed in the production of grain, would scarcely repay the cost of production. In a country which possesses superior manufacturing resources and capabilities, the exchange of manufactures for common food may therefore be a cause of rent without resorting to inferior soils.

Mr. Ricardo regarded the owners of land in the same light as the possessors of a monopoly, advantageous to themselves and proportionably injurious to the mass of consumers. Mr. Malthus proposed to modify this view of their advantages, and to consider them as originating only in a 'partial monopoly.' The former is accused of underrating the national importance of rents, and Mr. Malthus of overrating them. Under a system of free importation of the produce of the soil, it may be correct to consider the owners of land as possessed only of a 'partial monopoly,' but it is scarcely so when laws are passed which, except in seasons of high prices, prohibit the supply of provisions from foreign countries; and in this case the interests of the community do not coincide with that of the owners of land.

When the rights of property are fully established, rents will exist, whether they accrue to the farmer-proprietor or are paid by the farmer-tenant to a landlord. That quality of land which terminates in rent, Mr. Malthus regards as a boon most important to the happiness of mankind, and the main security against the time of the whole society being employed in procuring mere necessaries. 'This,' he observes, 'is the source of all power and enjoyment; and without which, in fact, there would be no cities, no naval and military force, no arts, no learning, none of the finer manufactures, none of the conveniences and luxuries of foreign countries, and none of that cultivated and polished society which not only elevates and dignifies individuals, but which extends its beneficial influences through the whole mass of the people.'

In Mr. Malthus's 'Principles of Pol. Econ.' the subject of section 7, chap. iii., is 'On the causes which may mislead the landlord in letting his lands, to the injury both of himself and the country.' Most of the considerations which he urges are of a practical nature, and relate to rent in agriculture. On this part of the subject the reader may refer to Grainger and Kennedy, 'On the Tenancy of Land in Great Britain.'

(Ricardo, Malthus, Mill, and MacCulloch's *Treatises on the Elements and Principles of Political Economy*; Professor Tucker's *Laws of Wages, Profits, and Rent investigated*, Philadelphia, 1837; Professor Jones's *Essay on the Distribution of Wealth and on the Sources of Taxation.*)

RENT (in Law Latin, *redditus*, 'a return') is a right to the periodical receipt of money or something valuable in respect of lands or tenements held by him from whom the rent is due. There are three kinds of rent—rent-service, rent-charge, and rent-seck.

There is rent-service when a tenant holds lands of his lord by fealty and certain rent, or by homage, fealty, and certain rent, or by other services and certain rent. Rent-service therefore implies tenure, and it may be due to the lord of the manor of which the lands are held, or to some other chief (that is, immediate) lord of the fee, or to the reversioner. The right of distress is an incident to rent-service in arrear, so long as it is due to the same person to whom fealty is due. Before the statute of Quia Emptores (18 Edw. I.), a person might make 'a feoffment in fee simple either by deed or without deed, yielding to him and his heirs a certain rent, which was a rent-service, and for this he might have distrained of common right; and if there were no reservation of any rent, nor of any service, yet the feoffee held of the feoffor by the same service as the feoffor did hold over of his lord next paramount.' (Litt., 216.) The statute of Quia Emptores enacted that the feoffee shall hold of the chief lord by the same services by which the feoffor held, and consequently no rent can now be reserved when a man transfers to another all his estate in land In order that rent-service may now be created, the person to whom the rent is reserved must have a reversion in the lands and tenements out of which the rent is to issue; but any reversion is sufficient. Thus a person who has a term of twenty years may grant it to another, all but one day, and this will leave him a reversion, so that a rent-service may be reserved, with its incidents of fealty and the right of distress. If he assign all his term, reserving a rent, but without a clause of distress in the assignment, he cannot distrain for the rent.

Rent-service therefore which has been created since the statute of Quia Emptores can only be reserved to the lessor who retains a reversion, and it will belong to the person who is entitled to the reversion. If a man seised in fee simple makes a lease of lands for years, reserving rent, the rent-service is descendible to his heir with the reversion; though all rents which accrue due to the lessor before his death will belong to his personal representatives. A rent-service reserved out of chattels real will of course belong to the personal representatives of the lessor. A rent is now most commonly reserved in leases for years, but it may be reserved on any conveyance which passes or enlarges an estate; and it may be reserved in the grant of an estate in remainder or reversion, or in a grant of a lease for years to commence at a future time.

A rent-service may be separated from the reversion or seignory, by the reversioner granting the rent and retaining the fealty: in this case the lands are still held of the grantor, but the rent is due to the grantee; not however as rent-service, but as rent-seck (rodditus siccus), so called, 'for that no distress is incident to it.' (Litt., 218.) If the seignory or reversion is granted, the rent-service will pass by the grant, and the grantee is entitled to receive the rent from the tenant from the time that he gives him notice of the grant, together with all rent that had accrued due since the grant, and is unpaid at the time of such notice.

Rent-service can only be reserved to the feoffor, donor, or lessor, or to their heirs, upon any feoffment, gift, or lease; and if rent is reserved generally, without specifying the persons, it will belong to the lessor, and after his death to those who are entitled to the reversion. Rent is payable at the times mentioned in the reservation, but not till the last minute of the day on which it is payable.

When rent-service is in arrear, the common-law remedy for the recovery of it is by distress. [DISTRESS.] By 4 Geo. II., c. 28, s. 2, every landlord who by the terms of his lease has a right of re-entry in case of non-payment of rent, may, when half a year's rent is due, and there is no sufficient distress on the premises, serve a declaration in ejectment on his tenant, without any formal re-entry or previous demand of rent, and a recovery in such ejectment is final and conclusive, unless the rent and all costs are paid within six calendar months after the judgment in the action of ejectment has been executed. The action may also be stayed before trial, if the tenant will pay or tender to the lessor, or pay into court, all the rent then in arrear, together with the costs. By the common law the lessor has also an action of debt for rent against a lessee for years or at will; and by the statute of Anne (8, c. 14, s. 4) there is also the same action against a lessee for life during the continuance of his estate, which had previously been given for arrears of rent after the determination of the estate (32 Hen. VIII., c. 37). A lessor may also have an action of covenant for rent, either by force of the implication contained in such words as 'yielding and paying' rent, or by force of an express covenant to pay, which is seldom omitted in any lease. If the lessee assign his interest in the term, he, and his executors so far as they have assets, are still liable under the covenants to the person entitled to the reversion. The assignee also becomes bound by such of the covenants as run with the land, and is consequently liable to an action upon them. There is also the remedy by action of assumpsit or debt for the use and occupation of land, which action lies without any express agreement for rent.*

Rent-service may be discharged in various ways. If the tenant be evicted from the lands demised to him, he is discharged from payment of the rent; and if the lessor purchase the lessee's interest, the rent is also discharged. The lessor may release a part of the rent-service, without releasing the whole.

If the person entitled to the rent-service purchases part of the interest in the land in respect of which rent is due, the rent-service is apportioned according to the value of all the land, and accordingly the tenant is discharged from payment of rent in respect of the part purchased. The person entitled to the reversion may also grant his interest in part of it, and the rent will be apportioned between him and his grantee; for the interest in the reversion is of a divisible nature, and the rent follows the reversion. If the lessee should be evicted out of part of the lands, there will also be an apportionment. Before the late alterations of the law, when the moiety of a reversion was extended on an elegit, the rent was apportioned, and the lessor consequently retained half of it. If a widow is entitled to dower of a reversion, she is also entitled to one-third of the rent reserved upon a lease for years made by her husband.

At common law, if a tenant for life died before the rent became due, which was reserved on a lease that determined by the death of the tenant for life, his personal representatives could not claim an apportionment of the rent, nor could the reversioner or remainder-man claim such portion as accrued due during the life of the tenant for life. But such an apportionment was given to the personal representatives by stat. 11 Geo. II., c. 19, s. 15. The act 4 and 5 Wm. IV., c. 22, extends the provisions of this act to rents reserved on leases that determine on the death of the persons who make them, though they are not strictly tenants for life, and on leases of lands held *pur auter vie;* and by the same act all rents-service reserved on any lease by a tenant in fee or for any life interest or under any power, and granted after the passing of this act, and all rents-charge and other rents, annuities, &c. made payable under instruments executed, or (being a will) coming into operation after the passing of the act, shall be apportioned, and a proportionable part thereof, from the last time of payment to the day of the death of the party interested therein, paid to the personal representatives of such party.

A rent-charge is a rent granted out of land either at common law or by the Statute of Uses, with a power of distress for the recovery of the rent. Such rents may be created by the owner of the land who retains the property of it; and they may also be reserved on the alienation of the land. These rents differ from rent-service in not being connected with tenure, and the remedy by distress is therefore not an incident to rent-charges, but is created by the same instrument which creates the rent-charge. If no power of distress is given, the rent is a rent-seck. Rent-charge may be created either by deed or by will. Sometimes, by the terms of the grant, the grantee of a rent-charge is empowered to enter on the land and satisfy himself for all arrears out of the profits of the land. When a rent-charge is created under the Statute of Uses (s. 4, 5) with a power of distress and entry upon the land in case of arrear, the person to whom the rent-charge is given obtains the legal estate in the rent-charge, with all the remedies for its recovery, as he would by a direct grant of the rent-charge; and the same instrument (lease and release) which creates the rent-charge may also make a settlement of the lands charged with the rent. In this way in a marriage settlement a rent-charge may be provided for the wife's jointure.

An estate in a rent-charge may be either in fee simple, in fee tail, for lives, or for years, according to the terms of the original limitation. A rent-charge of inheritance is real estate, and descendible to the heir; but a payment that is due belongs to the person representative. There may also be an estate in fee simple in a rent-service created before the statute of Quia Emptores. A rent-charge in fee simple is subject to curtesy and dower; and also a rent-charge in tail. But if a rent-charge be created and granted to a man and the heirs of his body, his surviving wife will not be entitled to dower if the husband dies without issue. Until the act 3 and 4 Wm. IV., c. 106, a woman was not entitled to dower out of a rent-charge, unless her husband had the legal estate in it. A rent-charge may be limited by way of remainder; and a new rent-charge may be created to commence at a future time.

A rent-charge may be discharged in various ways. If a man who has a rent-charge out of certain lands buys any part of them, the whole rent is discharged, for it issues out of the whole of the lands; and the consequence is the same if he releases all his right in any part of the land. But a man may release part of the rent-charge without affecting the remainder; and a division or apportionment of a rent by conveying part of it to a stranger is a valid conveyance If part of the lands which are subject to the rent-charge de scend to the grantee, the rent will be apportioned according to the respective value of the two parts of the land.

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* See a remark on this action, 6 A. and E., p. 339.

A rent-seck, as already mentioned, is not, like rent-service, accompanied with a right to distrain at common law; but by the stat. 4 Geo. II., c. 28, s. 5, this distinction in respect of remedy between rent-service and rent-seck, created since that statute, is abolished; and the act also applies to rent-seck created prior to the statute which had been duly paid for three years out of the last twenty years. Other rents, though they belong to one of the three divisions above mentioned, are often distinguished by particular names: thus the rent due from a freeholder is called a chief rent (redditus capitalis); the rents of freeholders and antient copyholders of manors are sometimes called rents of assise, being *assisi*, or ascertained, and also quit-rents (quieti redditus), because they are a quittance and discharge of all services.

A fee-farm rent is properly a perpetual rent-service reserved by the crown, or, before the statute of Quia Emptores, by a subject, upon a grant in fee simple. The purchaser of fee-farm rents originally reserved to the crown, but sold under 22 Car. II., c. 6, has the same power of distress that the king had, and so may distrain on other land of the tenant not subject to the rent.

By the stat. 42 Geo. III., c. 116, in cases where the land-tax has not been redeemed in due time by the owner of the land, it may be purchased by any other person, to whom it will belong as a perpetual rent-charge (though it is called a fee-farm rent in the Act), and the purchaser will have all the remedies for rent reserved on a lease.

By the 3 & 4 Wm. IV., c. 27, s. 42, no arrears of rent or of interest in respect of any sum of money charged upon or payable out of land or rent, or any damages in respect of such arrears of rent or interest, shall be recovered by any distress, suit, or action, but within six years next after the same respectively shall have become due, or some acknowledgment in writing given to the person entitled thereto by the person by whom the same was payable; except where there has been a prior mortgagee or other incumbrancer in possession of any land or receipt of the profits thereof within one year next before an action or suit shall be brought by a subsequent mortgagee, &c.; and then the arrears of interest may be recovered for the whole time such prior mortgagee, &c. was in such possession or receipt.

RENULI'NA. [FORAMINIFERA, vol. x., p. 348.]

RE'OLE, or RE'OLLE, LA. [GIRONDE.]

RE'OPHAX. [FORAMINIFERA, vol. x., p. 347.]

REPEATING CIRCLE. The principle of repetition from which this circle has its name was first explained by Tobias Mayer, professor of the university of Gottingen, in *Commentarii Societatis Regiæ Scientiarum Gottingensis*, tom. ii., p. 325, for the year 1752. Mayer found that the common surveying instruments were often inaccurate to 5′, while the quadrant, then used in all great scientific surveys, was, from its weight and price, and the trouble required for verifying and adjusting it, scarcely to be considered a portable instrument, but only fit for the observatory. The substitute which he proposed for geodesical purposes may be described briefly as follows:—Suppose a hollow tube fitting upon an axis, to which it can be clamped, when required, by a screw; the axis itself is fixed on the top of a staff. This part of the instrument is exactly similar to a common mounting for surveying compasses, &c., where greater stability is wanted than a ball and socket will give. On the top of the tube a flat bar is screwed, the plane of which is horizontal when the tube and axis are vertical; the bar and tube thus form one piece, which has the shape of a T. A second bar of the same length is placed exactly above the former. This latter bar moves easily, and without shake, on a pin concentric with the tube and axis, and thus can be placed at any angle with the fixed rule, and, as it is supposed, without at all disturbing it. Two fine dots are pricked towards the ends of each bar; the lines joining the dots in each should pass exactly through the axis of motion of the upper bar, and the dots must be equidistant from the centre. When this is so, the four dots will, in every position of the bars, be the angular points of a rectangle, and the equality of the opposite sides can be ascertained by measuring the distance with compasses. Finally, on the top of the upper bar a telescope with cross wires is fixed, the telescope being a little shorter than the bar, that it may not interfere with measurements between the dots.

The mode of measuring an angle with this instrument is as follows:—Let the two objects be R (that to the right) and L (that to the left). Set the fixed bar to some angle from ten to twenty degrees to the right of R by the motion of the tube on the axis, and clamp the axis-screw firmly; then, by the motion of the upper bar alone, bisect R with the telescope. Take, with a pair of compasses, the distance between the dots, apply the distance to a scale of chords, and you have the angle between the fixed bar and the object R. Call this angle θ. Now, by the motion of the upper bar alone, bisect the object L. It is clear that if the distance between the dots were again measured, and the angle deduced, as before, from the scale, we should have a measure of the angle required $+\,\theta$. But instead of measuring at present, let the telescope be brought back on R, *by unclamping the axis-screw and moving the whole instrument on its axis;* when this is satisfactorily performed, clamp the axis, and bisect L exactly as before, by moving the upper bar and telescope alone. The angle between the bars as deduced from measuring the chord between the dots will now clearly be twice the angle required $+\,\theta$. Let the operation be performed so many times, eight for instance, that the bars are nearly in their original position with regard to each other, and let the distance between the dots be measured and the corresponding angle be deduced from the scale of chords, which suppose to be ϕ, ϕ being larger than θ. If this last-mentioned angle had been θ exactly, it is clear that the bar would have come round exactly to its original position after having moved through 360°, but as it has besides moved over an angle $=\phi-\theta$, the whole angle moved through is $360°+\phi-\theta$, which is also eight times the angle to be measured: hence the angle subtended at the spectator by R and L is $\frac{1}{8}(360°+\phi-\theta)$. By continuing this process of stepping several times round, there seems to be no limit to the accuracy with which an angle can be measured, except that which depends on the imperfection of the telescope, the indistinctness of the objects, or the uncertain lateral effect of terrestrial refraction. Mayer used a scale of chords, probably because he was thus able to construct the instrument himself, and could dispense with any circular arc or divisions. We do not see that he has noticed one slight inaccuracy, viz. that as the dots lie in different planes, the distance between them is not the actual chord of the angle required, but is the hypothenuse of a right-angled triangle, the altitude of which is the thickness of the upper bar, while the base is the chord required; but this error is easily allowed for, and, when the angle to be measured by the compasses is of a tolerable size, is scarcely worth considering. If we conceive the plane of the lower bar extended and changed into a divided circle, while the upper bar becomes a vernier at each end, we should probably have the instrument Mayer would have proposed, had it been in his power to employ a tolerable mathematical-instrument maker. Mayer says that he invented this instrument eight years before the publication of his memoir.

The reward proposed by the English parliament for any means by which the longitude at sea could be determined, stimulated Mayer to perfect the method of lunar distances. For the successful solution of this problem two things are required—tables correct enough to predict the true place of the moon at any future time, and an instrument for measuring the distance between the moon and star with sufficient accuracy. Mayer fulfilled the first condition by his celebrated Lunar Tables, one copy of which was sent to the lords of the admiralty in 1755, and a later, improved up to his death (1762), forwarded by his widow in 1763.* For measuring the distance between the moon and star he proposed an instrument similar to Hadley's sextant, but in which the angle can be repeated or multiplied without intermediate readings off, similar in principle to the instrument just described.

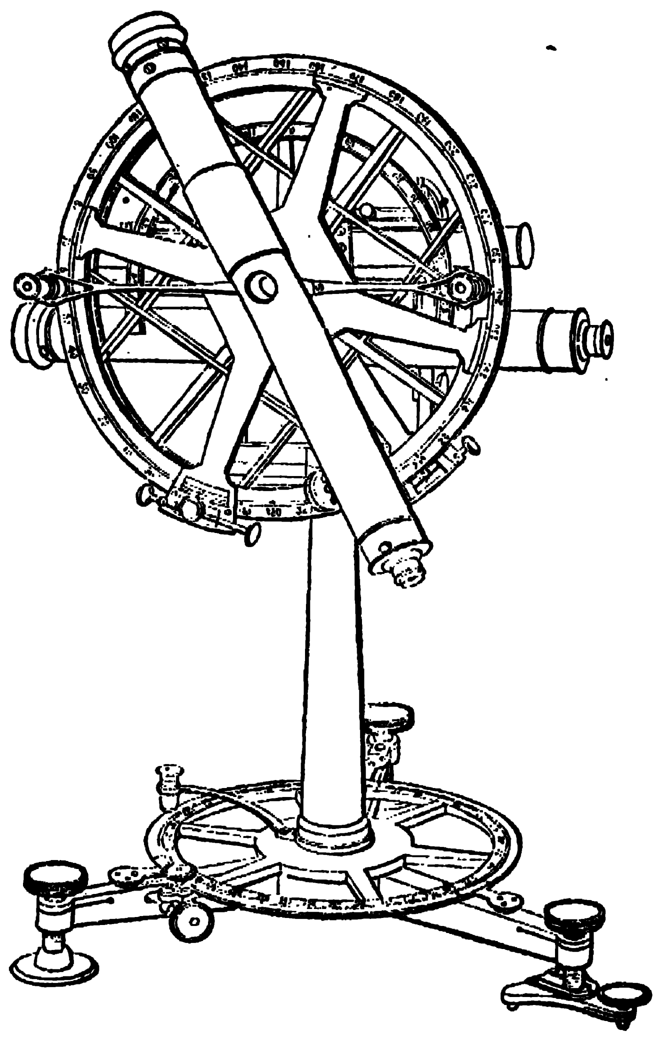
Mr. Troughton says (article 'Circle,' Brewster's *Cyclopædia*) that Bird was employed to make reflecting circles after Mayer's idea, but his dividing was so excellent, that the entire circle was thought useless, and the sextant preferred, as having a larger radius, and being lighter and handier.

In 1787 the Chevalier de Borda published his '*Description et Usage du Circle de Réflexion*,' in which he proposed a modification of Mayer's circle, so slight that at first sight it would almost seem trivial, but which gives an unquestionable superiority to this above every other form of reflecting instrument when well made and skilfully and *perseveringly* used. We shall return to Mayer and Borda's construction of the repeating reflecting circle in article SEX-

TANT, as they cannot be understood until the principle of reflecting instruments has been explained.

The date of the invention of the repeating circle which is the proper subject of this article, is somewhat uncertain: it is later than that of the reflecting circle. One was constructed in 1787, and employed in connecting the meridians of Paris and Greenwich. (See *Mém. de l'Académ.*; a Memoir by Le Gendre, 1797; and a Memoir by Cassini, 1798.) The *Connoissance des Tems*, An VI. (1797-8), contains the plate and description of a repeating circle, which was made by Lenoir for the astronomer La Lande. When the French government undertook the measurement of an arc of the meridian from Dunkirk to Barcelona, the commission to whom this operation was entrusted resolved to employ the repeating circle.

Fig. 1.



Borda's Repeating Circle.

This is one of the most complicated as well as ingenious of existing instruments, and obtained an immense reputation, from being the only instrument employed in the geodesical and astronomical observations of the great measurement of an arc of the meridian, on which the French have founded their modern system of measures, weights, and money. Since that time the construction has been altered by different artists, and generally with disadvantage. Partly owing to this cause and to the tendency to undervalue everything which has been once overrated, the repeating circle is now lower in reputation than we think it merits, though it must also be admitted that the great improvements which have been made in recent years, especially on the Continent, in the graduation of small circles, has rendered one principal merit of this construction, viz. the annihilation of errors of division, comparatively of small importance. From the superior execution of English instruments at the time when Borda's circle was in its highest fame, and the dislike of our countrymen to calculation, the repeating circle was never much or successfully used in England, though several have been made.

In this figure the general form of the instrument is shown tolerably well, but some of the essential motions are at the back of the circle, and these are drawn on a larger scale in a second diagram. The whole circle turns round on the vertical column, which has an inner axis of steel with good fittings at the top and bottom. It is usual and proper to make these fittings with great care, but it is not an essential condition to accuracy in the performance of the instrument.[*]

The top of the column finishes in a square bar, to which the upper works and circle are firmly screwed. We shall first describe the motions which are required for astronomical purposes, and point out the rest when the geodesical properties of this instrument are considered. The azimuthal circle is scarcely to be considered a part of the instrument.

The front telescope, its verniers, and clamp, are seen distinctly in front. (*Fig.* 1.) This moves very freely on a spindle within the axis of the circle. There is a level behind, a projecting end of which is seen in the figure. This and its accompanying back telescope are—one a little above and the other a little below the axis of the circle, and revolve on a collar which works on the outside of that axis. These can be fixed in any position by a clamp (also seen in the figure) which embraces the back edge of the circle: the back telescope is for measuring terrestrial angles. Finally, the axis of the circle itself passes through a fitting, on which it also turns freely, carrying telescopes, level, &c. without altering their position in respect to itself. There is a clamp to restrain this motion and fix the circle, the head of which is seen at A, *fig.* 2, and a tangent screw for slow motion at B. This is the weakest and most inconvenient part of the instrument, for the clamp holding so near the axis of motion has little power, and there is scarcely room for getting at the screw-head, while the slow-motion clamp is out of the way of the observer when he requires it for bisection. The large weight behind is a counterpoise, and the small level above is for setting the circle vertical. There is a clamp at C, which bites on the semicircle to make this adjustment and prevent its being deranged. We will describe the process of observing with the instrument when the object is a star at or near its meridian altitude.

Supposing everything to be adjusted, *i.e.* the axis and circle both vertical, the observer bisects the star with the telescope, he or an assistant having previously brought the level nearly to the corresponding points of its scale. The level is now read off, giving it time to settle if wanted. We suppose its graduation to be in seconds, and reckoned outwards from the centre of the scale. The verniers are read off, the instrument turned half-round on the vertical axis, the telescope clamp released, and the star again bisected by the telescope, using its peculiar clamp and tangent screw; and finally, the level is again read off. This operation is precisely the same in all circles having an azimuthal motion, and it is clear that if the verniers were again read off, the difference between the first and second readings would be (after it is corrected for the indication of the level) twice the zenith distance of the star. Let the circle be now reversed, the level clamp and circle-axis clamp be released, and the whole circle moved in its plane till the telescope points to the star, and let the star be bisected again by using the axis clamp and its tangent screw only. The level must be brought back to be horizontal while this is doing, and be actually *clamped* before the final bisection of the star is made. We conceive that this must be done at twice, even by two observers; and it may be done at twice by one, though in a longer time. If the reader has fully understood the process, he will see that the instrument is precisely as at the commencement, except that the telescope and its verniers have travelled over the circle, an arc equal to twice the zenith distance of the star. A repetition of the operation will carry the telescope verniers over four times the distance, and by continuing the process the final arc read off may be made any number of times twice the zenith distance of the star. If the series stops after ten such processes, the arc travelled over is twenty times the simple zenith distance. Let the verniers be now read off, then subtracting the first reading from the last, and

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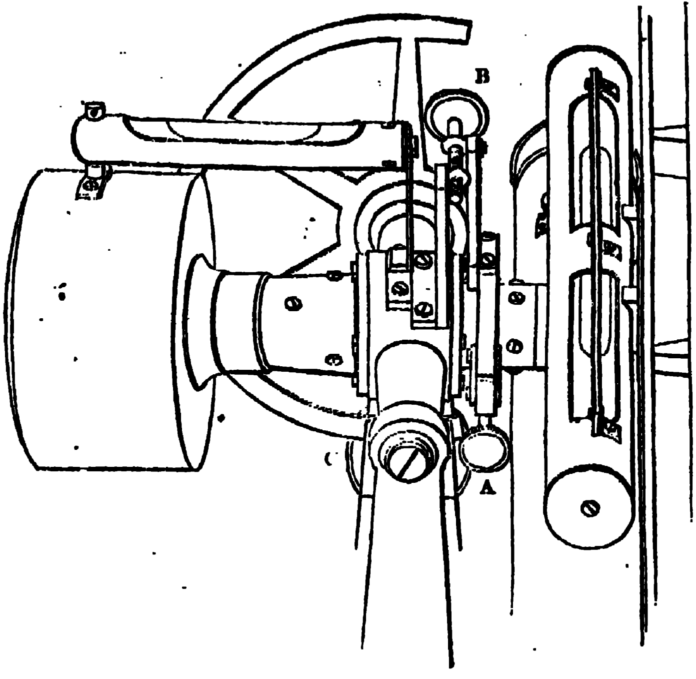
[*] Three thousand pounds were paid Mayer's widow for these Tables in 1765; they were printed by order of the Board of Longitude, under Maskelyne's superintendence; *Tabulæ Motuum Solis et Lunæ, autore Tobia Mayer*, Londini, 1770.

[*] In one of the expeditions sent to explore the North-West Passage, the repeating circle was found unmanageable because the superior contraction of the brass tube over the steel axis changed the close-fitting into a tight grasp which no force could overcome. This must always have given trouble, but ought not to have thrown the instrument out of use. If the whole instrument had been lifted up and turned half-round, bodily, and the level brought to its former reading, the double, quadruple, &c. zenith distances might have been observed just in the ordinary way. If the level forms one body with the circle during reversal, and keeps its zero unchanged, everything besides is unessential.

Fig. 2.



Back of Borda's Repeating Circle.

dividing by twenty, the result will be the zenith distance of the star, and the errors of division or of reading off will also be divided by twenty. If the number of repetitions which can be taken at one culmination are not thought sufficient to destroy these errors, the series may be prolonged on the following and subsequent nights, starting from the preceding reading without disturbing the verniers, until any number whatever are taken, the only essential condition being that in reversing, the level is undisturbed both in its attachment to the circle and in its own zero; and that in bringing the telescope on the star by turning the whole on its horizontal axis, the connection between the telescope and circle is permanent. The hour, minute, and second at which each bisection is made are to be noted.

We have said that it is better to read off the level than to attempt to bring the ends of the bubble exactly to the same division, which is really an impossible condition with one observer, and scarcely practicable even with two. The differences should be as small as they can be made with moderate care and in a moderate time; but a well ground level will measure small arcs better than any graduated limb or even than any small telescope can do, and it is therefore as safe to correct for an error of level as to adjust. The level readings should be registered as towards the object end and eye end, or − and +, along with the times, and the correction may be made to the final arc. It is clear that if the level were always brought to the same divisions, there would be no level error. The effect of a derangement of the vertical axis, which is shown by the level, is calculated as follows:—Let the reading of the level end towards the object be 10″ larger than the reading towards the eye. To correct this, the footscrew towards the observer should be raised 5″, when the two readings will agree; but now the telescope points 5″ *below* its former position, in which it bisected the star correctly. The telescope therefore must be raised, *i.e. the zenith distance must be diminished* 5″; hence if 5″ be subtracted from the multiplied zenith distance on account of that observation, the error will be corrected, and so on with every other instance. The rule is, add together all the level readings towards the object end, and prefix −; do the same with those towards the eye end, and prefix +; take their algebraic sum, and divide by twice the number of observations, and the result is the correction to be applied with its sign to the mean zenith distance. This will generally be a very small quantity. As the great difficulty in observing out of a regular observatory is in the reading off, the division of the level might be to every 2″, but numbered as single seconds. These would be better seen, and the divisor of the difference would be the number of observations. When the instrument is very small, and the probable circumstances under which the observer may be placed promise few facilities, the scale may be cut to 10″ only, with bold lines. A mistake of one or two tenths in guessing the subdivisions would be very rare, and scarcely cause a sensible error in the final result.

The circle has been supposed to be adjusted before observing; this is a very simple operation. First place the instrument with the footscrews in their cups, and let that footscrew be towards the observer which rests on the slow-motion piece. This is seen at *fig.* 1, on the right. Place the axis nearly vertical by guess, or, if there is an azimuthal circle, set the plane of that nearly horizontal by a box level. Then place the plane of the vertical circle upright by the cross level, and bring its plane to be parallel with the two footscrews which are *from* the observer; *i.e.* if the object is in or near the meridian, set the circle east and west. Bring the bubble of the main level to the same division at each end by its clamp and tangent screws, and then reverse the instrument (turn it 180° in azimuth). The level is to be brought again to the same divisions, half by its tangent screw, half by screwing the two footscrews an equal quantity in opposite directions. Now turn the circle a quarter round (place it in the meridian according to the supposition), and bring the bubble of the level to its proper position by the third footscrew only. This first attempt at adjustment need only be approximate, but it must be performed over again with considerable nicety. The slow-motion piece is, we believe, due to Borda, and is a very ingenious and useful contrivance for making a coarse screw do the work of a fine one. By placing the footscrew nearer to or farther from the line of the two studs, the elevating power of the screw can be reduced in any proportion, and the finest and slowest motion possible given to the instrument. We have used the slow motion for finally bisecting a star in observing with great comfort. It is more ready to the hand than any other part of the instrument, and the disturbance of the axis is of no importance, as the level must be read off at all events. The approximate bisection is performed by the other screws, and if the observer recollects which way the star is moving, the space through which the instrument is thus moved need only be a very few seconds. The cross level must be originally fixed and adjusted, after the plane of the circle is known to be vertical, either by hanging a plumb-line before the limb, or when the telescope bisects at the same time an object and its image reflected from a fluid. When the cross level is adjusted, the horizontal wire of the telescope may be set right by making a star in the meridian run along it, or else by bisecting a fixed object with it and afterwards moving the circle in azimuth. The object should run along the wire, and by twisting the wire-plate round may be made to do so.

In the astronomical use of the instrument the azimuthal circle is scarcely required, except to see that you have turned the circle 180° at each reversal. It is convenient to have a coarse division to show this; it is a relief to the eye, and prevents the possibility of catching a wrong star. Any stop which is adjustable and gives notice when the rotation has reached 180° will do. In many of Troughton's repeating circles there is a pin which is pressed by a slight spring against two holes in the azimuth circle, which are 180° apart. This is convenient enough if the observations are confined to Polaris or a very slow moving star, but wholly insufficient for stars near the equinoctial. It supposes besides that the feet of the instrument are almost exactly placed with respect to the meridian, which is not to be done at once. A bar moving rather stiffly on the vertical axis, and coming agains. a stop, seems a better contrivance.

For setting to the approximate zenith distance, there is a graduated semicircle attached to the level, which may be seen in the general view. This has its diameter parallel to the level. A slender bar is attached to the object end of the telescope, and passes at the back of the circle; this points out on the semicircle the approximate zenith distance of the star. In many circles which we have seen there are two slips of brass which slide with a little force on the semicircle, and the slight bar above mentioned is brought to *touch* each of these stops alternately. Nothing can be more convenient, but unfortunately, however well the clamps may be made, the contact between the bar and a stop forces the clamp somewhat, and the essential condition of the instrument, that these should be undisturbed, is destroyed. The bar should not be allowed to touch the semicircle at all, but stand freely from it. In this way, by alternately bringing the bar to the equal and opposite divisions, when either the telescope or the level is moved, the telescope will always be at the proper altitude when the level is horizontal. If any one should wish to use the repeating circle as an altitude and azimuth circle, or as a surveying instrument, the wires of the telescope must be set at right angles to the circle axis, by bisecting a distant and distinct object, reading the azimuthal verniers, turning the instrument half round, again bisecting the object and reading the verniers a second time. If the object be very distant, the azimuth circle may be set to the mean of the readings, and the object bisected by the horizontal screws which draw the wire-plate; but if very great accuracy is required, either two marks must be set up having the same distance from each other as lies between the two positions of the axis of the telescope, or the angle which this last space subtends at the distant mark must be allowed for. The instrument is not fitted for nice observation with the azimuth circle.

We have now explained the chief astronomical use of Borda's circle, which is that of determining the altitudes of stars upon the meridian by several observations near the meridian. There is a correction to be applied to the mean result, which is easily computed when the approximate latitude and exact time are known. The formulæ and tables required may be found in several works on astronomy, in Schumacher's *Hülfstafeln*, p. 38, and Baily's *Tables*, p. 154. The length of time during which the observations may be carried on depends on the altitude of the star and its proximity to the pole. Polaris might be observed safely beyond 36^m on each side the meridian, which is the extent of the present tables, and, in these latitudes, stars in or below the equinoctial for fully half an hour on each side. It is supposed that the error of the clock is well known, but even this may be wrong to a small amount without causing much error, if the number of observations on each side the meridian and the hour angles are nearly equal.

The repeating circle may be very well used for getting the time either by equal altitudes, or by absolute altitudes with one or two repetitions. For this purpose there should be three or five horizontal wires, and the instrument should be previously carefully adjusted. The instrument must be moved in azimuth, so that the star passes each wire near the centre, and nothing should be touched which affects the level. For illumination by night, there is an opening with a reflector in the centre of the telescope. This is objected to as weakening the telescope, but the other mode of illuminating by a small central reflector, or outer ring in front of the object glass, is inconvenient. Perhaps by taking a longer hold of the telescope and strengthening the intervening portion of the tube, the former convenient arrangement may be preserved without sensible loss of strength. The repeating circle, on Borda's construction at least, cannot be well employed in observing the sun without very careful screening. The level is so perpetually changing its zero, when exposed to the sun, that there is no possibility of saying what the instrumental zenith is.

One of the first operations which the observer must engage in, is to determine the scale of his level at different temperatures, and then he may, for small deviations, use the indications of the level, instead of worrying himself and losing his time in attempting to produce a perfect adjustment. The value of the scale is thus measured:—Bring the bubble towards one end, bisect a very well defined object with the telescope, and read off both scale and verniers. Then, by the slow-motion foot-screw, bring the bubble towards the other end, bisect the object again by the telescope, and read off the level scale. Now bring the bubble to its original position by the circle-axis clamp, and the telescope on the object by its own clamp, when everything is as at starting, except that the telescope has moved over the circle the sum of the angular motions pointed out by the level. This may be repeated till a sufficiently accurate value is got for the *whole* scale. To try the equality of the divisions of the level, place the foot-screw near the line passing through the studs of the slow-motion piece, and note the motion of the level for every *whole* revolution of the screw. Opticians of character are generally very careful about their levels and scales, but the practical astronomer should never trust where he can have proof.

We shall speak as briefly as possible on Borda's circle as a geodesical instrument, although it is an excellent surveying instrument, as the great French survey proves, but the same advantages can be obtained by a different application of the repeating principle. On looking at *fig.* 2, it will be seen that the whole of the upper circle, with its counterpoise, &c., revolves on a horizontal axis, and, by the two motions round the vertical and the horizontal axis, it is evident that the plane of the circle can be made to pass through any two points on the earth's surface. There is a little address and practice required to do this quickly and correctly, but it is easily learned. When it is effected, the adjustment will remain undisturbed to the end of the series of observations. The middle wire of the front telescope is supposed to have been adjusted perpendicular to its axis, and the middle wire of the back telescope may be adjusted similarly, or, what will do as well, may be made to bisect a very distant mark at the same time with the front telescope. The circle, being placed in the plane of the two objects, is clamped, and one observer bisects R, the right hand object, with the front telescope, while the assistant bisects L with the back telescope. Now release the circle-axis clamp, and move the circle round in its own place until R is bisected by the back telescope, clamp the circle again, and bisect L with the front telescope. It is clear that the front as well as the back telescope has been carried on to the right through the angle to be measured by the motion of the circle, and, therefore, when the front telescope is brought back to R, and over to L, that it has travelled over the face of the instrument twice the angle to be measured, which is therefore equal to the difference of the readings before and after the operation. Release the circle again, bring the front telescope to R by the general motion of the circle, and the back telescope on L by its own proper motion; the instrument is now in its original position, except that the divided circle has revolved as it were from right to left in its own plane (which also passes through the two objects L and R) twice the angle to be measured. By repeating the above process the motion given to the circle is four times the angle to be measured, and so on, the number of repetitions being only limited by the patience of the observers and the time they can bestow on their work. The repeating circle used thus is a very powerful instrument. As the angles in an accurate survey are never very small or very large, a little defect in the plane of the instrument or a slight non-parallelism between the planes of the two telescopes is of little injury, though, from the poor centring of the back telescope, defects of this nature are unavoidable. As both telescopes may be, and the back telescope always is, eccentric, there is a reduction to be applied to the angle on this account. Whoever wishes for a full account of these and similar reductions will find it in Delambre's *Méthodes Analytiques pour la Determination d'une Arc du Méridien*, &c., Paris, An VII.; in the *Discours Préliminaire*, by the same author, contained in the *Base du Système Mètrique Décimal*, vol. i., Paris, 1806; and in almost any modern French geodesical work. There is a very full account of the repeating circle, with all its verifications, &c., in the second volume of the last-mentioned work, pp. 160 *et seq.*, and the four volumes will supply examples of every kind of observation and reduction. As a geodesical instrument however the repeating circle of Borda has gone completely out of use, and probably for ever.

Borda's repeating circle possesses two most valuable properties: mere errors of division may be diminuted by sufficient patience; and the fatigue of reading off the divisions, the most ungrateful part of an observer's task, is greatly reduced. Hence, it may be asked, why is not the repeating circle in general use as a portable astronomical instrument? We should answer that, in the first place, the construction of Borda is by no means satisfactory for an *astronomical* instrument; it is weak, and heavy, and rickety. But if a *portable* astronomical circle is wanted, and to this class of instruments we should confine the repeating circle, we think the following alteration should be adopted. The telescope hangs loosely from its centre,* and whatever care may be taken by the artist, the flexure of each end must be considerable, probably different, and possibly varying from time to time with variations in the temperature. It should be grasped by two strong collars near the ends of a diameter of a vernier circle, and the telescope might then be safely extended three or four inches each way beyond the divided circle. Again, the axis clamp which holds the vertical circle should be fixed on the pillar and embraces the rim of the inner circle, the clamp of the level (for no second telescope is wanted) might be at the back, above, and quite out of the way. The whole circle should be brought as close to the upright pillar as possible, and perhaps its axis had better be fixed by the maker permanently at right angles to the pillar. This would take away much weight and give great firmness to the whole instrument.

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* If the object and eye end bend equally, there is no alteration in the direction of the line of sight; the only evil is that the oblique incidence of the rays on the object-glass deforms the image when the obliquity is considerable. The German artists of Reichenbach's school apply levers to telescopes hung by the middle, in order to counteract flexure. We prefer, on the whole, obtaining a maximum of stiffness, and then determining the effect of flexure which must be allowed for. There is no possibility of avoiding the investigation in any case where accuracy is demanded. Gambey takes a longer hold of the telescope, but in providing a motion for surveying when the circle is horizontal, we think he has lost something in stability when the circle is vertical.

It must however be admitted that unless there are two intelligent observers, or unless the base on which the instrument stands is so steady as to prevent the possibility of any derangement when the observer moves from the telescope to read the level, that errors may creep in, though not, as it seems to us, greater than in all other instruments *not* reflecting. We have previously cautioned circle observers, and the warning cannot be too strongly pressed upon our countrymen at least, that the *level* must *always* be noted contemporaneously with the *bisection* of the star. If the foundation of the instrument is immoveable, this will be the same as the level a minute after bisection, and so only one observer be required. But if the position of the instrument is affected by the weight or motion of the observer, the *level* after bisection is no test of the position *at* bisection, and two observers are absolutely necessary. In Borda's repeating circle, where the clamp is necessarily imperfect from the shortness of its bearing, it is impossible to move the front telescope without shifting the circle a little at the same time; but this is of no importance, for the level shows the change, and the reading off of the level, when properly applied, corrects this error.

It is precisely from not thoroughly considering this fundamental principle in the repeating circle, that the French, and, we believe, German artists, made an alteration in its construction, which introduced larger errors than previously existed. They applied the level not to the circle itself, but to the vertical column, which is, in truth, a much more convenient situation. Now if the clamp which holds the circle while the telescope is moved, were absolutely perfect, the result would be the same as if the level were attached to the circle; but suppose the clamp to yield a little, and it is clear that the angular motion of the circle causes an error in the observation, which is not pointed out by the level. In some instruments of this construction (*à niveau fixe*) the polish of the surface to be clamped was so fine that the clamp allowed the circle to slip very readily. Indeed it is easy to see, on theoretical grounds, that if there is any tendency to yield, no clamp is to be relied upon against a very small degree of force acting perpendicularly to its grasp. It is evident on consideration that Borda's repeating circle depends almost entirely on the truth and delicacy of the level, and on its forming one body with the circle during each pair of observations so completely, that no motion can take place in the circle which is not instantly pointed out and measured by the level. In constructing an astronomical repeating circle, we should recommend the motion of the telescope and verniers to be made as light and delicate as possible, or what Troughton called a *flying* motion, while the motion of the circle in its collar should be rather heavy, so as scarcely to be disturbed, when unclamped, by moving the telescope. This is however in the original repeating circle not necessary, but only convenient.

In judging of the repeating principle as applied to any instrument, attention should be paid to the perfect independence of the telescope and level with respect to each other, and of their perfect connection with the circle when they are clamped to it. In some instruments a sort of repetition has been attempted by having the circle turn freely on the telescope axis, and clamping it alternately to the telescope and to a vernier circle which carries the level. It seems difficult in any such construction to secure the immoveability of the circle while clamping and unclamping is going on, and the construction has, we believe, gone out of use. There are some precautions which should be observed in every repeating circle, which we shall describe in reference to Borda's construction. Besides the perfect independence of the level, the telescope with its verniers and clamps should be perfectly self-balanced, so as not to apply any force to the clamp in any position; the telescope should be moved on the circle by two fingers pressing in directions towards the extremities; the circle should be turned in its own plane by laying hold of the circle itself, and so gently that no jar can take place, or any springing back or forward of the telescope or its verniers from the moment of inertia: finally, the level must have time to settle before it is read off. When these precautions are duly observed, great accuracy may be obtained; in two instances, to our knowledge, where the latitude has been determined by unexperienced but intelligent observers, the results even of a single night have come within 1″ of the truth.

It may be worth mentioning that with the circle of Borda the measurements may be made by moving the telescope *contrary* to the order of divisions, *i.e.* if the first observation is made with the face to the right hand instead of the left. There is no advantage in this modification, except perhaps that as the screws are handled a little differently, any discrepancy between an angle measured in the two ways would show an error in one or both the methods. It would be advisable, where several series are taken, to vary the direction in which the telescope is brought to its new position, and that in which the circle is turned upon the star. The tangent screw might be worked either constantly one way or the other, or alternately, but we should not expect any sensible difference in the results if the instrument is well made and the observers careful. If two steady observers can be found, the double altitude of any star may be repeated, with the genuine Borda and its two telescopes, exactly as a terrestrial angle, *i.e.* by measuring the angle between the star seen directly and by reflexion from mercury. This would in theory appear to be the most perfect application of the instrument, as flexure has no effect upon the angle measured, being equal and in the same direction in both positions of the telescopes. The level is not wanted for this observation at all, but the circle must be set truly vertical. A single observer might indeed make the same observation with one telescope, as the level would show and measure any shifting of the circle. And here again the effect of flexure is eliminated from the observed double altitudes. Finally, double nadir distances may be observed of a star reflected from a mercurial horizon, exactly as double zenith distances are observed in the ordinary method. This last species of observation may have the advantage of being sometimes more convenient, but the chief reason why it is pointed out is, that the effect of flexure upon double nadir distances is equal, but in a contrary direction, to its effect on double zenith distances; the observer has thus an easy mode of ascertaining whether flexure exists and of measuring its amount and law.* We are not aware that any of the methods described in this paragraph have been put into practice.

What precedes refers almost entirely to the repeating principle when applied to measurements in altitude. Instead of the circle of Borda and its two telescopes, later artists have given a motion in azimuth to their theodolets, in addition to the motion of the telescopes and verniers, by which the angle can be measured precisely as in Mayer's original instrument. But in several instruments which we have seen there is a considerable probability of disturbing the circle clamp while moving the telescope or using its tangent screws. It is to secure the detection of any similar motion that a watch telescope, as it is called, is frequently added to English theodolets, and is indeed required for many, spoiled as they are by an unnecessary adjustment to zero, to save indolent or ignorant surveyors a simple subtraction. A watch telescope can scarcely be applied to a repeating theodolet, and we think that the repeating tripod may be so made as to be free from any objection. This was first constructed by Mr. Dollond on the suggestion of the late Astronomer Royal, and has been found very useful in the trigonometrical survey of Ireland.

The three foot-screws of an ordinary theodolet are placed in the three notches which are seen on the table of the tripod. This upper part turns heavily on a stout short centre, it is fixed by a clamp at A, and there is a tangent screw at B for giving slow motion. The steady action of the tangent screw is secured by a spring at C. It is evident that if, in using an ordinary theodolet, R (the right hand object) is first bisected, the circle read off, and then L (the left hand object) is bisected, the circle being again read off, that the difference between the two readings is the angle to be measured, *if the instrument has not been shifted*, and if the bisection reading off, &c. are perfect. Now suppose the whole instrument to be taken up and set down exactly concentric with its first position, without any other alteration, but with the telescope on R; if L be a second time bisected, the difference between this latter and the preceding reading will be also the angle to be measured, and therefore the vernier will have passed over twice the angle, reckoning from the beginning. If instead of this impracticable taking up and setting down again, the stand on which the theodolet rests can be turned round concentrically with the theodolet, so that R is bisected by the telescope, the theodolet itself being untouched, it is clear that the operation is equivalent to that just described, and consequently that the telescope being brought on L by its own motion, the measure is obtained of twice the angle required, and the process may be continued *ad libitum*, until the errors of reading off and of division are eliminated. The only precaution to be observed is, that the stand must receive no angular motion from the motion of the telescope, and this is easily effected by giving a certain massiveness to the stand and a considerable heaviness to its motion while the telescope and its verniers revolve as lightly as possible. The observer should satisfy himself as to this perfect independence of the two motions and the stability of his repeating tripod by taking a set of twenty repetitions of an angle, always moving the telescope forward in the order of the divisions, and a second set of twenty of the same angle, carrying the telescope round the contrary way. The two results should agree if the stand has no motion; and if they do not, the upper motion must be lightened or the lower be loaded till they do agree. We should not feel satisfied to use the repeating stand if a motion of the telescope a little ruder than necessary affected its position although unclamped; and the stand which is here figured fulfilled this condition very well with a 12-inch theodolet. As the absolute coincidence of the axes of the tripod and theodolet cannot be obtained, the angle should be repeated at least once round the circle, and, if the case requires it, until the multiple angle is very nearly equal to one, two, or more circumferences. The original repeating tripod as designed by Mr. Pond was considerably higher than that figured here. (See Pearson's *Practical Astronomy*, plate xxix., fig. 7, and vol. ii., p. 513.) A little greater nicety is thus given to the adjustment of the vertical axis of the tripod, which is not necessary, and the snugness of the present stand is, we think, more than an equivalent. The axis of the tripod must first be set vertical, either by a level of its own or the theodolet level, exactly as is described in the adjustment of the vertical column of Borda's circle. For the subsequent adjustments, &c. of the theodolet, see THEODOLET.

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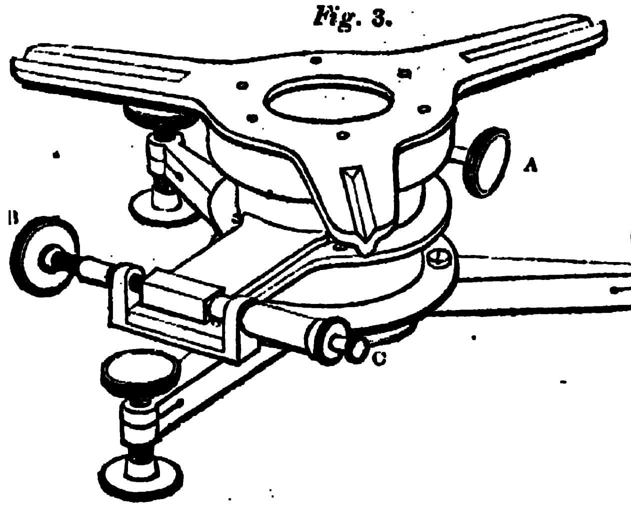
* We suppose that the apparent nadir distance of a reflected star is the same as the zenith distance of the star seen directly. The horizontal points of all the large circles which we know, vary to some extent with the altitude of the star observed, which seems contrary to what is here supposed. This last-mentioned discrepancy is one of the most perplexing points in modern practical astronomy. The amount is however so small as scarcely to vitiate sensibly any conclusion drawn from reflected observations with so small an instrument as a repeating circle.

Fig. 3.



Repeating Stand by Messrs. Troughton and Simms.

The best account of the repeating circle in English will be found in Troughton's article 'Circle,' Brewster's *Cyclopædia*, and in a paper by the same author, *Memoirs Astron. Soc.*, vol. i., p. 33, which is unfavourable to the repeating principle. (See too Pearson's *Practical Astronomy*, vol. ii., p. 488 et seq.) We do not agree with all Mr. Troughton's objections: some apply only to the defective construction of Borda; and others may be either got over by skilful handling, or belong to all small instruments. It must be remembered in reading his papers, that too much was then expected from this instrument, and that its proper sphere of action was absurdly extended. We doubt whether as good latitudes have been got with any small circles as with repeating circles, and it is to this purpose, we think, that they should be confined.

REPETEND, the part of a CIRCULATING DECIMAL which is perpetually repeated. The word however means simply *to be repeated*, and is so little used in the above sense, that it might be advantageously employed with more generality

REPLEVIN (*delivrance de namps, replegiatio*). In the middle ages the performance of legal duties was enforced by taking the person, the lands, or the goods of the defaulter into the custody of the party authorised to enforce the performance of such duties. When such a taking was effected, the party was said to be distrained (*districtus*, put under compulsion), by his body, his lands, or his goods, to do the act in respect of which he was supposed to have made default. [DISTRESS.]

Upon a distress being effected, the body, land, or goods, as the case might be, of the distrainee remained in the custody of the distrainor until the act for which the enforcing of the distress had been made was performed; unless the distrainee brought the question of the legality of the taking before a competent tribunal, in which case he might either await the result of his legal proceedings, or, if he was desirous of obtaining a more speedy liberation of the thing distrained, he might replevy it by giving a pledge or security for a replacing it in the custody of the distrainor in the event of the legal decision being in favour of the latter.

The alleged defaulter might contest the legality of the taking in an action of trespass. [TRESPASS.] But in this form of action he could recover damages only. He would not be entitled to the liberation of his body, lands, or goods, as the case might be, pending the suit; nor indeed when the suit had terminated in his favour, could he by any proceeding which could be resorted to in the action of trespass be relieved from the distress. The remedy by which a party was to recover his liberty or the property distrained, and also damages for the temporary detention, was an action of replevin. Where the person of the plaintiff was taken, his remedy was by an action of replevin in a peculiar form, which, taking its denomination from the writ by which it was commenced, was called de homine replegiando. This proceeding was however surrounded by so many difficulties, rendered perhaps indispensable by the necessity of preventing criminals from using it as a means of evading justice, that it has now become obsolete in England, parties entitled to redress by the writ of homine replegiando preferring to obtain their discharge by the more speedy and summary process of habeas corpus, or, as it was formerly called, a writ of corpus cum causâ. [HABEAS CORPUS.] The great mass of the cases of homine replegiando in the old law books arose upon the seizure and detention of persons whom the parties seizing claimed as their fugitive villeins [VILLEIN], and this process was frequently resorted to in Jamaica and other slave colonies. The seizing of the lands of a defaulter by way of distress has long ceased to be practised.

Formerly not only lands but incorporeal hereditaments were the subjects of replevin, of which a remarkable instance occurred in the reign of Edward III. (*Parliament Rolls*, vol. i., 45.)

The third form of replevin, and the only one now in use, is replevin of goods, called in the old statutes replegiari de averiis, cattle (in law Latin, averia) being the species of goods which usually formed the subject of a distress.

If the goods of a party were taken out of his possession against his will, he was entitled at common law to sue out a writ of replegiari facias, by which the sheriff of the county in which the goods were taken, or of the county in which they were detained, was required to cause the goods to be replevied, *i.e.* restored to the owner upon his giving pledges for the prosecution of his action, and also by statute pledges for the return of the goods to the distrainor in case a return should be adjudged. As the right of the party from whom the goods are taken to have the possession restored to him by replevin, depends upon the property belonging to him—if the taker of the goods claim them as his own property, the power of the sheriff is suspended, until the party has sued out a writ de proprietate probandâ, by which the sheriff is directed to summon a jury for the purpose of trying whether the goods are the property of the plaintiff or of the defendant; and if they are found to be the property of the plaintiff, then to replevy them; if of the defendant, the plaintiff's claim to be restored to the possession of the goods remains in suspense until the termination of the action. A special action lies at the suit of the crown and the party aggrieved, for falsely claiming property in the goods distrained, and thereby preventing a replevin.

A replevin does not lie for goods taken in execution, or for goods seized for a debt to the crown. In a very intemperate speech, addressed by Hyde, afterwards Lord Clarendon, to the House of Lords, upon a charge against the barons of the exchequer, for enjoining the sheriffs of London not to execute a writ of replevin for goods seized by the officers of the custom-house for refusing to pay the subsidies of tonnage and poundage, he is stated to have said, in the course of his argument, 'We all know a replevin lies against the king, if the goods be (be not?) in his own hands.' (Rushworth, part 2, vol. ii., 1361.) Though this strange assertion has been regularly transcribed by succeeding writers, it appears to be altogether unfounded. The replevins sued out for goods seized in respect of tonnage and poundage would issue against the officers as for goods seized by them in respect of debts claimed to be due to the crown. But goods seized for the king's debts cannot be replevied without the special mandate of the king or of the barons of the Exchequer. Still less could replevin be brought in respect of goods in the actual possession of the king, and upon an allegation of their having been wrongfully taken by him.

Replevin does not lie for goods taken in a foreign country, though afterwards imported here.

If upon a distress taken by the superior landlord upon premises in the possession of an under-tenant, the mesne or intermediate tenant puts his cattle in the place of those distrained, as by law he was allowed to do, he might replevy the goods so substituted, though the latter were never distrained.

Replevin lies notwithstanding an express agreement that the landlord shall be at liberty to distrain and hold the goods against pledges (that is, notwithstanding a tender of pledges) until the rent be paid; for goods cannot be made irreplevisable by the mere agreement of the parties.

Executors may maintain replevin for the goods of the testator taken in his lifetime, and a husband may bring replevin alone without naming his wife, for the goods of the wife taken before the marriage; as the property in the goods passes to the executors, and to the husband respectively, notwithstanding the seizure and detention.

A person may in some cases support a replevin without being the owner of the goods, as where the plaintiff is the bailee of the goods taken. [BAILMENT; PLEDGE.]

The writ of replegiari facias did not, as in the case of most other writs, confer upon the sheriff a bare ministerial authority: it operated as a commission clothing the sheriff with authority to determine the legality of the distress in the county court, in which he presides judicially. Notwithstanding the facility thus afforded, the remedy by writ of replegiari facias, which must be sued out of the Court of Chancery, was attended with great inconvenience and delay at a period when the chancery followed the person of the king, and many weeks might elapse before the party could obtain the restoration of his property. There existed also other difficulties connected with the execution of this writ. The inconvenience was felt as early as the time of Henry III., in whose reign it was provided by the statute of Marlbridge, passed in 1267, that if the cattle of any person be unjustly taken and detained, the sheriff, after complaint made to him thereof, may deliver them without hindrance or refusal of him who took the cattle. In 1554, with a view of making the delivery of distresses more expeditious, it was enacted by 1 and 2 Philip and Mary, c. 12, s. 3, 'that every sheriff of shires, being no cities nor towns made shires, shall at his first county-day, or within two months next after he hath received his patent of his office of sheriffwick, depute, appoint, and proclaim in the shire-town within his bailiwick, four deputies at the least, dwelling not above twelve miles distant from one another; which deputies so appointed and proclaimed shall have authority in the sheriff's name to make replevies and deliverance of such distresses, in such manner and form as the sheriff may and ought to do.' The proceeding by writ of replevin does not seem to be affected by the Uniformity of Process Act (2 Will. IV., c. 39, s. 21), which directs that the writs mentioned in that Act shall be the only writs for the commencement of personal actions in the cases to which such writs are applicable, inasmuch as none of these writs are capable of being applied to the objects to be accomplished by the writ of replevin.

The proceeding by plaint under the statute of Marlbridge, 52 Henry III., c. 21, has practically long superseded the proceedings by writ of replegiari facias. In numerous inferior courts jurisdiction is possessed, under charters from the crown, to hold pleas of replevin by plaint. By an act passed in 1284 (Westm. 2, c. 2), the sheriff is required, before he make deliverance of the distress, to take from the plaintiff pledges not only for the prosecution of the suit, but also for returning the cattle in the event of a return being adjudged. This statute is silent as to the amount in which security should be taken. For the purpose of fixing the extent of the responsibility of the pledges and of preventing vexatious replevins in cases of distress for rent, it was enacted in 1737 (by 11 Geo. II., c. 19, s. 23), that sheriffs and other officers having authority to grant replevin shall in every replevin of a distress for rent, take, in their own names, and before any deliverance is made of the distress, from the plaintiff and two responsible persons as sureties, a bond in double the value of the goods distrained (such value to be ascertained by the oath of one or more credible witness or witnesses not interested in the goods or distress, such oath to be administered by the person granting such replevin), with a condition for prosecuting the suit with effect and without delay, and for duly returning the goods and chattels distrained in case of a return being awarded.

By this latter statute the sheriff or other officer granting the replevin is authorised to assign the replevin bond to the avowant (the party who took the distress in his own right), or to the person making cognizance (the party acknowledging the taking of the distress on behalf of some other person, and as his bailiff, for the term applied to any person undertaking this species of agency, the duty of taking distresses having been formerly part of the ordinary duties of the bailiffs of manors); and the assignee of the bond is thereby empowered to sue upon it in the superior courts, in the event of the condition of the bond not being performed.

Although the county court has jurisdiction over the matters in dispute in actions of replevin, whether the proceeding be by writ or by plaint, the usual course, after security has been taken and the property returned, is to remove the proceedings into the Court of Common Pleas. This is commonly effected by a writ of recordari facias loquelam, called familiarly by practitioners a re. fa. lo., whereby the sheriff is commanded that he cause the plaint to be recorded which is in his county court between A and B, of the cattle, goods, and chattles of A, said to be taken and unjustly detained, and that he have that record before the justices at Westminster under his seal and the seal of four knights of the county, of such as shall be present at the said recording, and that he give a day to the parties to be in court. This proceeding is evidently borrowed from the Norman practice of requiring the presence of four knights to constitute a record in certain cases, though in other cases other persons might be recordeurs [RECORDER], the supreme recordeur being the duke of Normandy himself (Grand Coustumier), all whose courts therefore, whether in Normandy or in England, in which he was supposed to be present, were courts of record. If the plaint which was required to be removed was not in the county court, but in the court of the lord of a franchise, the writ directed the sheriff to go to the lord's court, taking with him four knights, and there to cause the plaint to be recorded. This particular form of re. fa. lo. is called an accedas ad curiam. In some cases, proceedings in replevin may be removed from the county court into the Common Pleas by writ of pone loquelam; and where such proceedings are depending in an inferior court of record, they may be removed into any of the three superior courts by writ of certiorari.

Upon the appearance of the parties in the Court of Common Pleas (or the removal may be into the Queen's Bench, and, if from an inferior court of record, into the Exchequer also), the plaintiff declares against the defendant for the taking of the goods and chattels of the plaintiff, at such a time and in such a place, and unjustly detaining them against sureties and pledges (that is, notwithstanding the plaintiff had offered security to perform the act required, in case it should be found that he was liable so to do), until they were replevied. This is the ordinary form, and it is called declaring in the detinuit. But if the goods have not been restored to the plaintiff, the declaration charges that he still detains them. This is called declaring in the detinet, in which the plaintiff claims damages large enough to cover the whole value of the goods taken from him; whereas in replevin in the detinuit, the damages recoverable are for the taking and for the short detention, until the replevying, which, as the goods may be replevied immediately, are merely nominal, and a small amount to cover the expense of the replevin bond.

The declaration being delivered, and a rule to plead being given, and a demand of plea made, the defendant either confesses the action, or suffers judgment by default, or pleads or demurs to the declaration. In the first case, final judgment is entered for the sum confessed. In the second case, interlocutory judgment is signed, and a writ of inquiry issues to assess the amount of the damages which the plaintiff has sustained by reason of the taking and detaining of his property. If the goods have been restored to the plaintiff, the damages will be measured by the inconvenience and the expense incurred in getting them back; if, as is seldom the case, they have not been restored, the amount of damages will include the value of the goods at the time of their being taken.

Thirdly, the defendant may plead or demur to the declaration. In replevin there is no general issue, properly so called, that is, a plea which puts the plaintiff upon proof of all the material allegations in the declaration. If the defendant plead non cepit, he admits that the goods belong to the plaintiff, and denies the taking only. If he plead that the goods do not belong to the plaintiff, he admits that he took and detained them. The allegation that the defendant detained the goods against sureties and pledges, is considered as a mere form, and not traversable. Therefore, although the action of replevin was given for the purpose of trying the validity of distresses, yet as no proof of any tender of security for the performance of a duty distrained for can be required from the plaintiff, the action of replevin may, in effect, be maintained upon any species of wrongful taking; and in Ireland this form of action is not unfrequently resorted to as a mode of trying a disputed right of property in goods. But where the taking was not wrongful an action of replevin does not lie, as where the defendant acquired the possession by delivery from the plaintiff, although the possession has been wrongfully continued, for which injury the proper remedy is an action of detinue (Com., *Dig.*, 'Replevin,' A.); though even in the case of a bailment (consignor against consignee), Lord Redesdale, then chancellor of Ireland, refused to quash a writ of replevin.

In ordinary cases, the defendant avows in his own right, or makes cognizance, as bailiff to his employer, for rent, or for some other duty or cause, for which a distress is allowed by law [DISTRESS], in doing which he may set up any ground of distress, though differing from that expressed at the time when the distress was made.

The plaintiff may reply to the defendant's plea as in other cases [PLEADING]; but inasmuch as an avowant, or a person making cognizance, is not merely a defendant, but a party seeking to recover something, the plaintiff's answer to an avowry or cognizance, which is in the nature of a declaration for the right or duty withheld, is called a plea in bar to such avowry or cognizance; the defendant's answer to which plea or bar is called a replication.

The pleadings in replevin vary according to the nature of the claim which formed the subject of the distress, and the circumstances under which the plaintiff is enabled to meet such claim. (Com., *Dig.*, 'Plead.' (3 K); Selw., *N. P.* 'Replevin;' Wilkinson *On Replevin.*)

If upon issue joined, a verdict is found for the plaintiff, the jury usually assess the damages; but if they omit to do so, a writ of inquiry issues to assess damages for the taking and detention, and also for the value of the goods, if it appear either by the pleading or by a suggestion by the plaintiff on the roll that the goods have perished or are still detained. But when the taking was lawful, and the detention only wrongful, no damages are given for the taking, as where goods are distrained damage feasant (wrongfully encumbering the defendant's property) and are impounded after tender of sufficient amends. Upon a judgment for the plaintiff on demurrer, a writ of inquiry issues to assess the damages, framed, as in other cases, with reference to the state of the record. Where there is judgment for the defendant upon verdict or demurrer, or the plaintiff is nonsuited, the judgment directs that the defendant shall have the goods restored to him without being again subject to being replevied, which is called a return irreplevisable; and by 17 Car. II., c. 7, on distress for rent, if the plaintiff in replevin by plaint, or writ depending in any court at Westminster, be nonsuited before issue joined, the defendant making a suggestion in nature of an avowry or cognizance for such rent, the court is directed, upon his prayer, to award a writ to inquire what rent is in arrear, and the value of the goods and cattle distrained; and on the return of the inquisition the defendant is to have judgment to recover the arrears of rent, if the goods, &c. distrained amount to that value, otherwise to the value of the distress, with full costs; and if the plaintiff be nonsuited after avowry or cognizance, and issue joined, or a verdict be for the defendant, the jury are to inquire the amount of rent in arrear, and the value of the distress; and if judgment be for the defendant on demurrer, the court is to award a writ to inquire the value of the distress, and the defendant is to have judgment for the arrears mentioned in the avowry or cognizance, if the distress amount to so much, otherwise to the value of the distress, and his costs.

If upon a replevin, either by writ or plaint, or upon a writ of retorno habendo after judgment, the sheriff returns that the cattle, &c. are driven away (eloigned, elongata) so that he cannot replevy them, a writ may issue commanding the sheriff to make reprisals by taking the cattle, &c. of the distrainor, and to detain them until he is able to replevy the cattle, &c. of the distrainee. This process, which is now nearly obsolete, was called a capias in withernam, or a capias by way of counter-taking, from *wither* (against; in German, *wider*) and *nam*, a taking or distress. A special action of trespass also lies for removing a distress so that it cannot be replevied. This latter offence was formerly called a 'vee,' or 'vetitum namium,' by which term is to be understood, not, as might be supposed, a forbidden distress, but a distress forbidden or refused to be replevied.' (2 *Inst.*, 140.)

If after goods have been replevied, and before the suit has been decided, the defendant makes another distress for the same cause, such second distress is called a recaption, and the course is to sue out a special writ for the restoration of the goods and for the punishment of the recaptor; since, whether the first taking was right or wrong, the defendant is not justified in thus anticipating the judgment of the court. It is not material whether the second taking be of the same goods or of other goods, provided they belong to the same party, and are taken for the same cause; but if the landlord distrain the goods of A, who replevies, and afterwards, finding the goods of B upon the land, he distrains them for the same rent, no writ of recaption lies. B can only replevy or bring an action of trespass or trover.

At common law, if the plaintiff was nonsuited, although the defendant became entitled to a return of the goods, yet the judgment was not that the return should be irreplevisable, as in a judgment upon a verdict where the right had been tried. The plaintiff might have again sued out a replevin, and so after several successive nonsuits. To put an end to this vexatious proceeding, the statute of Westm. II., c. 2, gave the plaintiff a writ of second deliverance instead of a new replevin, in which, if the plaintiff in any manner fail in his suit, the defendant will have judgment for a return irreplevisable. In other respects the proceedings in the action of second deliverance are similar to those in the action of replevin.

REPLICATION. [PLEADING.]

REPORTING. [NEWSPAPERS, p. 195.]

REPORTS (in Law) are relations of the proceedings of courts of justice. They contain a statement of the pleadings, the facts, the arguments of counsel, and the judgment of the court in each case reported. The object of them is to establish the law, and prevent conflicting decisions, by preserving and publishing the judgment of the court, and the grounds upon which it decided the question of law arising in the case. The records themselves are not easily accessible to the public, and they contain only the decision itself.

The earliest reports extant are the 'Year-books.' It is said that some few exist in MS. of the reign of Edward I., and a few broken notes are to be found in Fitzherbert's abridgment. A series of these commences, and are now printed, from the reign of Edward II. They were published annually, which explains their name, from the notes of persons, four in number, according to Lord Coke, who were paid a stipend by the crown for the purpose of committing to writing the proceedings of the courts. These early accounts of cases are very short, abrupt, and often confused, especially from the circumstance that it is frequently difficult to ascertain whether a judge or a counsel is speaking. At that time judges were dismissed at the pleasure of the crown, and after their dismissal returned to their previous position of counsel.

The Year-books continue, with occasional interruptions in their series, down to the reign of Henry VIII. The omission during the time of Richard II. has been attempted to be supplied by Bellewe, who collected and arranged the cases of that period which had been preserved by other writers. The Year-books are wholly written in Norman-French, although by the 36 Edw. III., stat. 1, c. 15, it was enacted that all pleadings should be in the English language, and the entries on the rolls in Latin. The Norman-French continued to be used by some reporters even as late as the eighteenth century. The last which appeared in that tongue were those of Levinz and Lutwyche; the former in 1702, the latter, in French and Latin, in 1704. The Year-books of later date have more continuity of style and fullness of discussion: cases are cited, and the decision of the court is given at greater length, with more solemnity and clearness. About the end of the reign of Henry VII. it is probable that the stipend was withdrawn. Only five Year-books exist for the ensuing reign, and none were published after it. Lord Coke observes, you may see no small difference between the cases reported in the reign of Henry VIII. and those previous. Their place was shortly afterwards supplied by reports compiled and published by private individuals on their own responsibility, but subject for some time to the inspection and approbation of the judges, whose testimony to the ability and fitness of the reporter is often prefixed to the Reports. This however soon became a mere form, as appears by the statement of Lord-Keeper North, who speaks slightingly of the Reports in his time as compared with his favourite Year-books.

North had such a relish for the old Year-books that he carried one in his coach to divert his time in travel, and said he chose it before any comedy. He thought the Year-books of Henry VII. the best for the student to begin with, as the law then became more settled; and was of opinion that they were better than the recent Reports, as 'compiled by men solemnly authorised, and not as now, when every ordinary practiser publisheth his Reports as he pleaseth, and the bookseller procureth an imprimatur.—And thus the shelves are loaded with Reports.' (Roger North's *Life of Lord-Keeper North*, vol. 1, pp. 27, 28.)

During the reign of Henry VIII. and his three successors, Dyer, afterwards chief-justice of the Common Pleas, took notes as a reporter. Benloe and Dalison were also reporters in these reigns. In the time of Elizabeth many eminent lawyers reported the proceedings of the courts, and, from the ability with which they acquitted themselves, added to the previously unsettled state of the law, the Reports of about this period have acquired very great authority. Anderson, Moore, Leonard, Owen, Coke, and Croke all lived about this time. But the first printed accounts of cases published by a private hand are those of Edmund Plowden, the first part of which appeared in the year 1571, under the title of 'Commentaries.' [PLOWDEN.] A few years afterwards the executors of Dyer published the notes of their testator under the express name of 'Reports,' being the first published under that title. These were followed, in 1601 and 1602, by those of Sir Edward Coke, which, from their excellence, have ever been dignified by the name of 'The Reports.' During this time reporters did not, as they have done in more modern times, confine themselves to one court. In the same volume are found reports of cases in chancery, in the three superior courts, the court of wards, &c. During the reign of James I., Lord Bacon and Sir Julius Cæsar suggested to the king the appointment of two officers for the purpose of taking notes and minutes of proceedings in the courts. James acceded to the suggestion, and a copy of his ordinance for their appointment, at a salary of 100*l*. each, is still extant. (Rymer's *Fœdera*, 15 Jac. I., 1617.) The ordinance does not however appear to have been acted upon, and Reports continued to be compiled and published by private hands only.

The English language was first used by reporters about the time of Elizabeth. Lord Coke employed it in his 'Commentary upon Littleton.' In his preface he states why he thought it convenient to do so; and adds that his conduct was not without precedent. From the period of Elizabeth down to the present, reports have been published of the proceedings in all the courts. During most of the time contemporaneous reports exist of the same cases, though frequently given under different names. Coke, in his day, thought the following distich applicable:—

> 'Quæritur ut crescunt tot magna volumina legis;
> In promptu causa est, crescit in orbe dolus.'

This is curious as evidencing the number and fecundity of reporters at that time. North also complains of the great number of Reports.

(Coke's *Reports*, Preface to part 3; Dugdale's *Origines Juridicales*; Reeves's *History of the English Law*.)

REPRIEVE (from the French *repris*, withdrawn), in criminal law, means the withdrawal of a prisoner from the execution and proceeding of the law for a certain time. Every court which has power to award execution, has also power, either before or after judgment, to grant a reprieve. The consequence of a reprieve is, that the delivery or the execution of the sentence of the court is suspended. A reprieve may proceed from the mere pleasure of the crown expressed to the court, or from the discretion of the court itself. The justices of gaol delivery may either grant or take off a reprieve, although their session be finished, and their commission expired. A reprieve proceeding from the discretion of the court is usually granted when, from any circumstance, doubt exists as to the propriety of carrying a sentence into execution. This doubt may be created either from the unsatisfactory character of the verdict, the suspicious nature of the evidence, the insufficiency of the indictment, &c., or from the appearance of circumstances favourable to the prisoner. When a reprieve has been granted with a view to recommend to mercy a prisoner capitally condemned, a memorial to that effect is forwarded to the secretary of state, who recommends the prisoner to the mercy of the crown, and to a pardon, on condition of transportation or some lighter punishment. Where it has been granted by reason of some doubts in point of law as to the propriety of the conviction, the execution of the sentence is suspended until the opinion of the judges has been taken upon it. The sentence is then executed or commuted in accordance with their opinion.

There are two cases in which a reprieve is necessarily granted. One is where a woman who has been capitally convicted pleads her pregnancy in delay of execution. Where such a plea is made, the judge must direct a jury of matrons to inquire of the fact; and if they find that she is quick with child, the execution is delayed, either till after her delivery, or proof by lapse of time that she was not pregnant. The other is where a prisoner appears to have become insane between judgment and the award of execution. In such case a jury must be sworn to inquire whether he really is insane. If they find that he is, a reprieve must be granted. (*Termes de la Ley*, 498; Hale, *P. C.*; 2 Hawk., *P. C.*, book ii., c. 51, s. 8, 9; 4 Bl. *Com.*)

In practice a reprieve is thus granted:—Before leaving an assize town, a calendar containing the names, offences, and sentences of the prisoners is prepared by the clerk of assize, and is signed by the judge. If he thinks proper to reprieve any one of them, he writes the word 'reprieved' in the margin of the calendar, opposite to the name of the prisoner, as follows:—

'*Reprieved.*	A. B. for the murder of C. D.	To be hanged.'

If he leaves A. B. for execution, and subsequently reprieves him, he writes to the under-sheriff and the gaoler to say so, and such letter from the judge stays execution.

If the reprieve is sent by the secretary of state, it is under the sign manual of the king.

REPTILES. *Reptilia.* The word reptile, in its general sense, signifies any creature that creeps upon the ground; but when used zoologically, it is confined to the designation of those quadruped, biped, and apod oviparous and ovoviviparous vertebrated animals that breathe by means of lungs principally, and are without hair, feathers, or mammæ. Such animals form the subject of that branch of zoological science termed *Herpetology*.

In mammalogy and ornithology we find that the animals which are treated of under those branches are respectively formed according to one leading type, which, however modified, may be traced throughout the whole chain of beings with which those branches of zoology are conversant. From an elephant to a mouse, from a whale to a porpoise, the same uniform principle of construction may be recognised. The same principle of organization [illegible] of an ostrich and a humming-bird. [illegible] we have various types or principles of structure. Not to dwell upon the more obvious differences in the organization of a tortoise and a common snake, we shall find in more cognate creatures, the Saurians for example, a striking variation in structure. The skeleton of a crocodile differs widely from that of a chameleon, as a glance at the figures given in this work of the osseous parts of each will show; and how widely are these again separated from the frogs and toads.

But before we proceed to inquire into the more remarkable differences of structure observable in reptiles, it will be necessary to observe what animals have been included in that class by zoologists.

The antient monuments of the Egyptians prove that the great groups of the tortoises, the lizards, the serpents, and the frogs, as well as their habits, were well known to that people; and the Sacred Scriptures abound in passages (the Old Testament especially) showing that a similar knowledge obtained when they were written. Indeed from the earliest times these forms must have attracted the attention of man; and a natural desire on his part to ascertain which of them were dangerous, and which were innocuous, must have led him to particular inquiry in order to solve the doubt.

In Herodotus and Athenæus, there are not wanting passages indicative of precise notions respecting many species of reptiles.

That this class of animals had employed no small portion of the acute observation of Aristotle, and that he was well acquainted with their form, structure, and habit appears from the great work which has justly immortalised him as a zoologist. We need only refer to the following passages in his 'History of Animals' to be well satisfied of the fact (lib. i., c. 1; lib. ii., c. 10, 17; lib. v., c. 3, 4; lib. viii., c. 2, 17). We find noticed the oviparous quadrupeds, viz. the land and marine *Testudinata*, the crocodiles, the lizards, &c.; the serpents, with an observation that they may be placed at the side of the lizards, as resembling them closely, if we suppose the lizards to be lengthened and deprived of their feet. The frogs are also often mentioned. Aristotle was quite aware of the generation of most of this class; he knew that the viper was ovoviviparous, and states that it brings forth its young alive, having produced an egg internally (ὁ μὲν ἔχις ἔξω ζωοτοκεῖ ἐν αυτῷ πρῶτον ὠοτοκήσας); and he indicates what animals should be designated as *amphibia*.

Pliny writes much and elegantly concerning this class; but the best of his observations are borrowed from Aristotle, and his far from well-digested compilation is mixed up with so great a portion of error and so large a measure of credulity, as justly to merit the censure passed by Cuvier on this voluminous and pleasant author, but too often fabulous natural historian.

Darkness settles on the period from the fourth to the ninth century as far as the history of the sciences is concerned; but at that epoch the best Greek works were translated by the Arabs, who thus handed on the most curious known facts, especially those which had any reference to the art of medicine. Again there is a great void till the early part of the sixteenth century, when France produced Belon and Rondeletius, Italy Salviani, and Switzerland that prodigy of erudition, as he is designated by Boerhaave, Conrad Gesner. Two of Gesner's books are devoted to the natural history of reptiles—lib. ii., *De Quadrupedibus oviparis*, and lib. v., *De Serpentium Naturâ*. These treatises are not mere catalogues with cuts; they are learned and elaborate dissertations, in which the antient and modern nomenclature of the object treated of, its form, its geographical position, its manners, its habits, its anatomy, its economical and medical uses, and its mythological history are discussed.

Towards the end of the same century, Aldrovandi appeared. The results of fifty years research in collecting objects of natural history, the drawings which he caused to be made of them, and his diligent studies relative to every point bearing on their history, appeared after his death, which happened in 1605, in fourteen volumes folio. The two books upon serpents and lizards do not appear to have been published till 1640, when they were given to the world by Professor Ambrosini of Bologna: twenty-two chapters are occupied by the serpents, and six only are dedicated to basilisks, dragons, and other lizards, the greater part of which however are fabulous.

Jonston's *Historia Naturalis*,* edited by Henry Ruysch, son of the celebrated anatomist, under the title of *Theatrum universale omnium Animalium*, is principally a selection of the remarks of those who preceded him, and he has but few observations which can be called his own; still fewer indeed than Aldrovandus, who does not abound in originality. The fourth book treats of digitated oviparous quadrupeds, and there are two books on the serpents; but if little can be said of his originality, he certainly deserves praise for the attempt at systematic arrangement which his work exhibits, and which has the merit of exactness. His chapters, in point of fact, form a methodical table. Thus we have a treatise on frogs, toads, and tree-frogs; on the lizards, on the tortoises; and on the serpents.

But it is to our countryman John Ray that we owe the first arrangement which can be truly called systematic: in his *Synopsis methodica Animalium Quadrupedum et Serpentini generis*, which first appeared in 1693, we have a classification based on the mode of respiration, the volume of the eggs, their colour, &c. This basis is not indeed strengthened by any description of the habits or organization of the reptiles on which he treats, and cannot but be considered as insufficient; still it is valuable, and has the merit of leading the way to more accurate methods.

The *Amphibia* form, in the last edition of the *Systema Naturæ*, published by Linnæus himself, the third class of the animal kingdom. This class consists of three orders:—

1. *Reptiles*, which are described as *pedati, spirantes ore*.
2. *Serpentes*, which are characterised as *apodes, spirantes ore*.
3. *Nantes*, which are characterised as *pinnati: spirantes etiam branchiis lateralibus*.

The last order, which consists of cartilaginous and other fishes, forms no part of our present inquiry, which is confined to animals included in the two first.

The *Reptiles* are thus designated:—*Os respirans pulmonibus. Pedes quatuor:*—and they consist of the genera *Testudo* (Land, Marine, and Freshwater Tortoises); *Rana* (Frogs and Toads); *Draco* [DRAGON]; and *Lacerta*, which includes the Crocodiles and the rest of the Saurians.

The *Serpentes* have the following general character:—*Os respirans tantum pulmonibus. Pedes nulli, pinnæve natatoriæ nullæ. Aures nullæ:* and they comprise the following genera:—*Crotalus* (the Rattle-Snakes); *Boa* (Boas and Pythons); *Coluber*, including all serpents which have abdominal scuta and subcaudal scales, whether poisonous or not; *Anguis*, including the Slow-worms, *Bipes* and other serpents, the poisonous *Cerastes*, &c.; *Amphisbæna;* and *Cæcilia*.

The work on oviparous quadrupeds, published by Klein in 1751—*Quadrupedum dispositio brevisque Historia Naturalis*—requires hardly any notice, and another which made its appearance in 1755—*Tentamen Herpetologiæ*—deserves as little. The latter, notwithstanding its extensive title, treats only of serpents; and the value of the criticisms of this opponent—he cannot be called rival—of Linnæus may be appreciated by his arranging in the same category the Earthworms, Tapeworms, and Leeches.

But it is to the *Specimen Medicum*† presented by Laurenti at Vienna, in order to obtain the degree of Doctor, that we must look for the first well-digested history of reptiles. This remarkable work, which omits the Tortoises, but, in other respects may be said to have formed an æra in the science of Herpetology, is divided into two parts: the first relates entirely to the natural history and characters of the genera; the second is devoted to specific descriptions, and the record of experiments made to detect the existence of poison in some species, and the effect of remedies in certain cases. But though this most able treatise is always quoted as that of Laurenti, it has been attributed to Winterl, a distinguished chemist of Vienna, whose name appears only in the last page of the work as having been the assistant of Laurenti—or rather his *collaborateur*—in his therapeutic experiments.

The author or authors of this valuable book assign the following characters to the class of *Reptiles*, which are described as cold animals, without hairs or mammæ, furnished with lungs, which act without a diaphragm, and generally without ribs, the functions of which are performed by the throat in first drawing in the air and then driving it into the lungs; as hybernating for a very long period, not masticating their prey, but swallowing it entire, and digesting it very slowly; as capable of long fasts (often for half the year), et copula diu fungentia; as renewing their youth, as it were, by casting their skins; and as objects of suspicion to man, and indeed all other mammiferous animals.

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* This is the most esteemed edition, and was published in 1718, in two vols. fol. Jonston's 'Thaumatographia Naturalis in decem classes distincta' appeared at Amsterdam in 1632. There are several editions of the 'Historia Naturalis.' That of Amsterdam (1657) is in one vol. folio.

† 'Exhibens synopsin Reptilium, emendatum cum experimentis circa venena et antidota Reptilium Austriacorum,' Viennæ, 1768, 8vo.

The Tortoises, as we have seen, are not comprised in the work which bears the name of Laurenti. The reptiles there treated of are separated into three orders, viz. *Salientia*, *Gradientia*, and *Serpentia*.

The *Salientia* consist of the Toads and Frogs; the *Proteus* of Laurenti, which appears under this order, being the larva of the *Rana paradoxa*. The reptiles under the order *Salientia* are characterised as having the posterior feet* proper for leaping, the body without scales, the epidermis mucous, the ears hidden by a membrane, neither teeth nor nails (excepting the *Pipa*),* no sexual organs reaching beyond the *cloaca*, and the loss of the tail as a consequence of the metamorphosis. For the genera the reader is referred to FROGS [vol. x., p. 494].

The characters of the second order, *Gradientia*, are the possession of four feet proper for walking, which cannot operate without the elevation of the abdomen from the ground, and a distinct neck and tail. The genera consist of the *Protei*, forming the 5th genus; 6th, the Tritons, or Aquatic Salamanders; 7th, the Terrestrial Salamanders; 8th, *Caudiverbera*, corresponding to the *Uroplates* of Duméril and Bibron; 9th, the Geckos; 10th, the Chameleons; 11th, the Iguanas; 12th, the Basilisks; 13th, the Dragons; 14th, the *Cordyli*, which correspond to the *Agamæ*; 15th, the Crocodiles; 16th, the Scincks; 17th, the *Stelliones*; and 18th, *Seps*, which last conducts us to

The third order, *Serpentia*, which are defined as having a rounded body, in which neck and tail are confounded, a repent progression, dilatable jaws, not solidly articulated, a very extensible œsophagus for the reception and deglutition of a disproportioned prey; and genital organs opposed and placed on the margins of the *cloaca*. The genera are 19th, the *Chalcides*; 20th, the *Cæciliæ*; 21st, the *Amphisbænæ*; 22nd, the *Orvets* (*Anguis*); 23rd *Natrix*; 24th, the *Cerastes*; 25th, the *Coronelles*; 26th, the *Boæ*; 27th, *Dipsas*; 28th, *Naja*; 29th, the Rattlesnakes (*Caudisona*); 30th, *Coluber*; 31st, the Vipers; 32nd, the Cobras; 33rd, the Asps; 34th, the Constrictors; and 35th, the Flat-tailed Serpents (*Laticauda*).

Though there is room for criticism with regard to the distribution of parts of this arrangement and the omission of that great and interesting class of reptiles the *Testudinata*, no zoologist will deny the lucid and natural views of the author, nor accept the *specimen* as any other than a most valuable advancement of herpetological science.

It will be seen that we have omitted the great work of Roesel on Frogs, which being limited to that particular race, is noticed in the article which bears their name. [FROGS.]

Though Scopoli devoted but a few pages to the Reptiles, his observations must not be passed by. The pupil of Linnæus, he showed himself worthy of his master: but at the same time he appears in his arrangement to have been fettered by the principles adopted by the great Swede, though he varied the application of them. In his 'Introduction to Natural History' (1777), in which he commences with the *Infusoria*, and concludes with the *Mammalia*, the *Amphibia* form the tenth tribe, and are divided by him into the true *Amphibia* (Reptiles and Serpents), and false or Ichthyomorphous *Amphibia* (the Chondropterygian fishes). The true Amphibia are separated into Serpents and Reptiles, and the latter are subdivided into two orders, viz those which possess a tail, and those which are deprived of that member (*Ecaudata*). The genera do not differ from those of Linnæus, though the characters of them are otherwise defined, but not improved. Scopoli, in his admiration of the brevity of his great master, has carried his own to the very verge of obscurity.

The Count Lacépède (1788, 1790) divided the Reptiles into three great groups:—

I. *Oviparous Quadrupeds*, subdivided into (1) those which possess a tail, and (2) those which are tailless.

II. *Biped Reptiles.*

III. *Serpents.*

Of the tailed oviparous quadrupeds the Tortoises form the first genus, and are separated into two sections:—1st, —those whose toes are united, unequal, and flattened into fins (the Marine Tortoises or Turtles); 2nd, those whose toes are short and moveable, and nearly equal (Fluviatile and Terrestrial Tortoises)—twenty-four species in all. [TORTOISES.]

The second genus, comprising the Lizards, consists of those reptiles which have no carapace; they are divided into eight sections or subgenera—the Crocodiles, Tupinambis, Iguanas, the true Lizards, the Chameleons, the Geckos, the Chalcides, the Dragons, and the Salamanders—fifty-six species in all.

The second section of the Oviparous Quadrupeds consists of the Frogs and Toads, which are divided into three genera, containing thirty-three species. [FROGS, vol. x., p. 495.]

The second great group, or the Oviparous Bipeds, comprehends those reptiles which have two feet and a tail, and is subdivided into—1st, those which are provided with anterior feet only; 2nd, those which are furnished only with posterior feet.

The third great group, or the Serpents, consists of those reptiles which have neither feet nor fins: they include nine genera. [SERPENTS.]

But the genera recorded in the system of Lacépède are not the only genera which he has established. Many of a date posterior to that of his system will be found in the *Annales du Muséum* and other works; but in the former principally.

In 1799 the method of Mr. Alexandre Brongniart was read to the French Academy of Sciences, and it seems to have been first published in the 'Bulletin des Sciences,' in 1800; it was afterwards printed among the other Memoirs of the National Institute. His classification may be regarded as a considerable step in advance of those who had preceded him, and had principally confined themselves to external characters, well defined doubtless, but of little moment when compared with those based on organization and habits. Whilst they carefully attended to the presence or absence of tail or feet, they neglected those essential points which spring from generation and development. Brongniart pointed out the approximation of the Tortoises to the Lizards, and even to the Serpents, and was the first to show that the Toads, Frogs, and Salamanders ought to constitute a separate order.

The following are the orders of M. Alex. Brongniart:—

I. *Chelonians* (Tortoises). These are toothless as far as regards implanted teeth, but their jaws are covered with a trenchant horny substance; their body is protected by a convex carapace; their heart has two auricles; their stomach is more voluminous than that of other reptiles, and their intestinal canal is provided with a cæcum;* they copulate, and lay eggs with a solid calcareous covering. The principal nourishment of this order is derived from vegetables.

II. *Saurians* (Lizards). These have implanted teeth, two auricles to the heart, ribs, and a sternum. The male has an external organ of generation, and they perform a true copulation; they lay eggs with a calcareous shell, and the young do not undergo a metamorphosis.

III. *Ophidians* (Serpents). These have long arched ribs. The male has an internal organ of generation; but they perform a true copulation, and lay eggs with a calcareous shell, and their young are hatched in all respects like the parents. They differ from the Saurians in having a heart with but one auricle,† no sternum, a double penis in the male, the shell of the egg soft though calcareous, and no feet.

IV. *Batrachians*. These have but one auricle‡ to the heart, and no ribs, or the rudiments of ribs only, a naked skin without scales, and no feet. The male has no external organ of generation, and no true copulation takes place; the eggs being most frequently fecundated out of the body of the female, are shell-less, and laid in the water. The young are hatched with branchiæ or gills, and in the early stages of their existence differ from their parents.

The method of Lacépède seems to have found more favour in the eyes of M. Latreille than that of M. Alex. Brongniart, which last must have been known to the former when he published his 'Natural History of Reptiles,' in 1801 He places in his *first* division the Oviparous Quadrupeds whose body is provided with feet, dividing them into two sections, according as they have unguiculated or clawless toes, and a scaleless skin. His *second* division is formed by the Serpents; and in his *third*, designated by the name of *Pneumobranchians*, he places the genera *Proteus* and *Siren*, as well as another, which he names *Ichthyosaurus*, which last is only a Tadpole.

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* An error, the *Pipa* is not an exception. [FROGS, vol. x., p. 496.]

* This exists as an exception in the *Chelonia*.

† All serpents are now known to possess two auricles.

‡ But it is divided internally into two chambers.

In 1825, when the science had very much advanced, M. Latreille, in his 'Families of the Animal Kingdom,' published another arrangement, which MM. Duméril and Bibron have digested into the following table:—

HE'MACRYMES PULMONE'ES.

CLASSES.	SECTIONS.		ORDERS	FAMILIES.
Reptiles	Cuirassed		Chelonians	Cryptopods (Testudo, &c.).
				Gymnopods (Saurochelys, Trionyx, &c.).
			Emydosaurians	Crocodilians (Crocodiles, &c.).
	Scaly	Saurians.	Lacertiform	Lacertians (Monitor, &c.).
				Iguanians (Iguana, &c.).
				Geckotians (Gecko, &c.).
				Chameleonians (Chamæleo, &c.).
			Anguiform	Tetrapods (Scincus, Seps, Chalcides).
				Dipods (Bipes, Bimanus).
				Apods (Anguis, Ophisaurus, &c.).
		Ophidians	Idiophids	Amphisbænians (Amphisbæna, &c.).
				Cylindrical (Tortrix).
				Coluberians (Acrochordus, Boa, Python, &c.).
				Anguivipers (Bongarus, Hydrophis, Pelamys, &c.).
				Vipers (Crotalus, Berus, Naja, &c.).
			Batrachophids	Gymnophids (Cæcilia).
Amphibia			Caducibranchians	Anurous (Pipa, Bufo, Rana, &c.).
				Urodeles (Salamandra, Triton, Axolotl).
			Perennibranchians	Ichthyoids (Proteus, Siren).

In 1802 and 1803 appeared the 'Traité Général' of Daudin. In this distinguished work (for with some faults, which a happier state than fell to the lot of the unfortunate author [DAUDIN] might have prevented, distinguished it is and will be) the method of M. Alexandre Brongniart is followed, in so far as the division of the Reptiles into four orders. In the three sections of *Chelonians* fifty-seven species are named and described. In the order *Saurians*, Daudin first places *Crocodilus*, with its three subgenera [CROCODILE], and then the genera *Draco*, *Tupinambis* (in which he describes several new species), *Lacerta* (subdivided into the Ameivas, the Collared, Ribanded, Spotted, Gray, Dracenoid, and Striated Lizards—thirty-one species in all, and including the genera *Trachydromus*, *Draco*, *Basiliscus*, and *Agama* (which last is subdivided into five sections), *Seps*, and *Chalcides*. The third order, *Ophidians*, contains numerous and natural genera, some of them rather overloaded, *Coluber* for instance, under which one hundred and seventy-two species are arranged; and others with only one or two. The fourth order, *Batrachians*, appears to have employed his particular attention. [FROGS, vol. x., p. 494.] He includes *Salamandra* and *Triton* in one genus, and assigns a single species to the genera *Proteus* and *Siren*. Such is a mere sketch of the great work of Daudin, founded, as he himself declares, upon his personal examination and study of five hundred and seventeen species.

In the short notice published by George Cuvier, in his 'Tableau Elémentaire de l'Histoire Naturelle' (1798), he divided the Reptiles, like Lacépède, into *Oviparous Quadrupeds*, *Serpents*, and *Biped Reptiles*. Even at this early period we trace the enlarged and penetrating character of the mind of this great zoologist in the leading idea of making the organization of animals the basis of their classification, in the new views regarding the divisions of the orders, and the important reformation in the characters assigned to certain genera up to that time. In 1817, when the first edition of his 'Règne Animal' was given to the world, we find that he had not neglected the interval which had thrown so much light on this branch of zoology, and that, abandoning entirely the systematic divisions which he had adopted in his 'Tableau Elémentaire,' he founds the whole of his arrangement on the structure of animals and their external and internal conformation. In 1829, when the second edition, the last which received his own revision, of the 'Règne Animal' appeared, we find this classification retained, with some slight corrections; and the following is a synoptical table of his method as applied to the Reptiles:—

				ORDERS.						FAMILIES.
Heart with an Auricle.	Double	Limbs: Jaws	Horny, without teeth	*Chelonians*						Chelonians.
			Toothed	*Saurians*	Feet	Ordinary: toes to the number of	Five before, four behind			Crocodilians.
							Five to four feet: Tongue	Bifurcated, extensible		Lacertians.
								Not extensible: Body	Ordinary.	Iguanians.
									Flattened	Geckotians.
								Vermiform, very extensible.		Chameleonians.
						Very-short, or to the number of four at least				Scincoidians.
		No Limbs		*Ophidians*	Skin	Scaly: eye	With three eyelids			Anguis.
							Without a third eyelid			True Serpents.
						Naked				Naked Serpents.
	Single.			*Batrachians*						Batrachians.

Most of the leading genera and subgenera belonging to these families will be found under their several heads in this work. We will here only call attention to the *Batrachians*.

					GENERA.	SUBGENERA.
Tail.	None.				Rana	Rana, Ceratophrys, Dactylethra, Hyla, Bufo, Bombinator, Rhinella, Otilophus, Pipa.
	Long.	Feet to the number of	Four	Lungs without branchiæ	Salamandra	Terrestrial and Aquatic Salamanders, Menopoma, Amphiuma.
				Branchiæ and lungs	Proteus	Axolotl.
			Two		Siren	

Oppel (who had been a diligent attendant at M. Duméril's course of lectures in 1807 and 1808, and in whose works much of the lessons of the latter are to be traced, as Oppel himself acknowledges), after publishing, in the nineteenth volume of the *Annales du Muséum*, a Memoir on the Ophidians, and another on the Batrachians, produced in 1811, at Munich, his treatise *Die Ordnungen, Familien, und Gattungen der Reptilien als Prodrom einer Naturgeschichte derselben* (thin 4to.).

The following synoptical table exhibits Oppel's method:—

REPTILIA	Testudinata		Chelonii.
			Emydæ.
	Squammata	Saurii	Crocodilini.
			Geckoides.
			Iguanoides.
			Lacertini.
			Scincoides.
			Chalcidici.
		Ophidii	Anguiformes.
			Hydri.
			Crotalini.
			Viperini.
			Constrictores.
			Pseudovipera.
			Colubrini.
	Nuda	Apoda.	
		Caudata.	
		Ecaudata.	

Other writers besides Oppel have evidently profited by the lectures of M. Duméril, who promises, at the end of the excellent *Erpétologie* by himself and M. Bibron, now in the course of publication, a complete table, setting forth his ideas on this branch of zoology. Those ideas, as far as can be collected from the parts already before the public, are sound and philosophical; being marked by acute observation, minute detail, and deep research, which are made subservient to general and enlarged views of the whole subject.

In 1790 Merrem published a paper in German, with the title of *Materials for a Natural History of Amphibia,** and in 1820 and 1821 two other papers followed. These papers treat of serpents and several genera of Saurians, and are illustrated with coloured plates. But his system appears to have been published (in 1800) at the suggestion of Bechstein, who had translated Lacépède's 'History of Reptiles' into German; and in 1820 a second edition of this system, which is shown in the following table, made its appearance:—

CLASSES.	ORDERS.	TRIBES.	SUBDIVISIONS.	
PHOLIDOTA	*Testudinata:*	with feet	Pinniform. Digitated.	
	Loricata (Crocodiles)			
	Squammata	Gradientia	Ascalabotæ. Sauræ. Chalcidici.	
		Repentia (Anguis, Ophisaurus, Acontias).		
		Serpentia	Gulones.	Innocui. Venenati.
			Typhlini.	
		Incedentia (Chirotes).		
		Protulentia (Chamæleon).		
BATRACHIA	Apoda (Cæcilia).			
	Salientia (Rana, &c.).			
	Gradientia	with eyelids	Mutabilia (Salamandra, &c.).	
		without eyelids	Amphipneusta (Hypochton, or Proteus).	

M. de Blainville, in 1816, published, in the *Nouveau Bulletin des Sciences de la Societé Philomatique,* the prodromus of his systematic distribution of the animal kingdom, which he produced, in 1822, in his *Principes d'Anatomie Comparée.* Under the type *Osteozoaria* and the subtype *Ovipara* or *Amastozoaria,* he places the reptiles, which he divides into two classes, viz.: 1, *Reptiles* or *Ornithoïd Squammifers;* 2, *Amphibians* or *Nudipellifers, Naked Icthyodians.*

The first class is separated into three orders:—

I. *Chelonians,* consisting of the genera *Testudo, Emys, Chelys, Trionyx, Chelonia,* and *Dermochelys* (Sphargis).

II. *Emydosaurians,* or crocodiles, divided into three subgenera.

III. *Saurophians* or *Bipenians,* which are separated into two suborders:—

A. *Saurians,* consisting of the families of Geckoidians, Agamoïdians (the Normal, as *Agama* and *Basiliscus,* and the Anormal, as *Chamæleo* and *Draco*), the *Iguanoïdians, Tupinambis,* and the *Lacertoidians* (divided into *Tetrapods, Dipods,* and *Apods*).

B. *Ophidians,* which are divided into

1. The *Dipods* (Chirotes).

2. *Apods*—α (with numerous teeth), *Pelamys, Hydrophis,* the *Vipers,* and the *Lethifers*—β (without venomous teeth), the *Amphisbænas,* the *Climbers* or *Boas,* and the *Colubers.*

The second class, *Ichthyoid* or *Nudipelliferous Amphibians,* is composed of four orders:—

1. The *Batrachians,* divided into two suborders—α (Aquiparous), *Rana,* &c.; β (Dorsigerous), *Pipa.*

2. The *Pseudosaurians* or Salamanders.

3. The *Subichthyans* or True Amphibians (*Proteus, Siren*).

4. The *Pseudophidians* (*Cæcilia*).

Mr. John Edward Gray published, in 1825, his *Synopsis of the Genera of Reptiles* and *Amphibia,* in the *Annals of Philosophy.* He considers the *Reptiles,* or scaly-skinned group, and the *Amphibia,* or naked-skinned group, as distinct classes.

The class *Reptilia* are thus defined:—Body covered with scales or hard plates imbedded in the skin; heart with two auricles and one ventricle, respiring by lungs. The blood is cold; the windpipe ringed; the ribs are perfect, and there are several vertebræ; the penis is distinct, sometimes double. The egg is covered with a shell, mostly hatched in the body of the mother.

The orders of the *Reptilia* are divided into two sections

1.

Body covered with imbedded hard plates.

Ears closed with a valve	Emydosauri.
Ears naked, valveless	Sauri.

2.

Body covered with scales, or two large shields

Legs 2—4 weak; ears naked	Saurophidii.
Legs 0; ears 0	Ophidii.
Legs 4; body covered with two shields	Chelonii.

Mr. Gray then remarks that 'Mr. Macleay, in his excellent *Horæ Entomologicæ,* has observed that the order of this class appears to assume a circular disposition; the most visible break in this arrangement is in the passage between the snakes and the tortoises; for the connection between the latter order and the crocodiles must be visible to every one, if they only consult Shaw's figures of the *Testudo serpentina,* and compare it with that of the crocodile, for it is in fact a crocodile with a shortened body, covered with united instead of distinct shields, and a bird's beak. The passage from the crocodiles to the lizards by means of the monitors has been long known to naturalists, who have often considered the latter as species of the former genus; and even Linnæus placed them in the same section of his genus Lacerta. The Scincs have always been placed in the same genus or group with the lizards; but their affinity with the slow-worms did not escape the penetrating eye of Linnæus, who observes that the *Lacerta Chalcides* is 'Media inter Lacertas et Angues,' and the union of the genera *Scincus, Anguis,* and *Amphisbæna* into an order, although it has not been done by any zoologist that I am aware of, appears to be strictly natural, for the feet in this order exist in such various degrees of development, that the being with or without them appears to be only a family or generic character, and not ordinal. Linnæus placed the genera *Tortrix* and *Eryx* of the true serpents as species of his genus *Anguis,* thus showing that he considered them as nearly allied. So far the passage from one order to the other has been very easy and gradual; and indeed sometimes I have been doubtful, as in the last case, to which order I should refer the genera. There is every reason to believe, from general structure, that there exists an affinity between the tortoises and the snakes; but the genus that exactly unites them is at present unknown to European naturalists, which is not astonishing when we consider the immense number of undescribed animals which are daily occurring. Mr. Macleay thought that these two orders might be united by means of *Emys longicollis* (the long-necked tortoise) of Shaw; but the family to which this animal belongs appears to be the one which unites this class to the crocodile: if I may be allowed to speculate from the peculiarities of structure which I have observed, I am inclined to think that the union will most probably take place by some newly discovered genera allied to the marine or fluviatile soft-skinned turtles and the marine serpent.'

Mr. Gray then proceeds to develop his system as follows:

§ 1. *Body covered with imbedded hard plates; legs distinct, fit for walking.* Loricata, *Gray,* not *Merrem.*

Order I. *Emydosauri,* Blainv.

Ears closed by two longitudinal valves; anus longitudinal; body covered with large imbedded plates; tongue short, adnate; legs four; toes four before, five behind; sternum long; clavicles none; lungs not extended to the abdomen; *living in or near water.*

Families: 1. *Crocodilidæ.* 2. *Ichthyosauridæ.* 3. *Plesiosauridæ.*

Mr. Gray thinks that *Megalosaurus* of Buckland is, perhaps, allied to this order.

Order II. *Sauri,* Blainv.

Drum of the ears naked or covered with skin; anus transverse; body covered with large and small imbedded scales; legs four, toes five, before and behind; sternum short; clavicles distinct; lungs extended into the abdomen; *living mostly on land.*

§ I. *Tongue not extensile.* Ascalabota, Merrem.

Families: 1. *Stellionidæ.* 2. *Geckotidæ.*

§ II. *Tongue extensile.* Sauræ, Merrem.

Families: 3. *Tupinambidæ.* 4. *Lacertinidæ.* 5. *Chamæleonidæ.*

Order III. *Saurophidii,* Gray.

Drum of the ear deep-seated, partly covered with a posterior transverse valve or by the skin; eyes furnished with longitudinal eyelids; skin covered with uniform imbricate scales, or rings of square plates; feet two, or four, small, weak, sometimes wanting; occipital condyle three-cut; lungs two, unequal, or rarely only one; ossa quadrata one on each side;* upper maxilla immoveable.

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* Beiträge zur Naturgeschichte der Amphibien.'

§ I. *Body covered with imbricate scales; anus transverse, not terminal; tongue extensile.*

Families: 1. *Scincidæ*, Gray. 2. *Anguidæ*.

§ II. *Body covered with intricate* (imbricate?) *scales; anus terminal.*

Family: 3. *Typhlopidæ*, Gray.

§ III. *Body covered with rings of square scales.*

Families: 4. *Amphisbænidæ*, Gray. 5. *Chalcididæ*.

Order IV. *Ophidii*, Brongn. (Serpentes, Linn.)

The drum of the ear wanting; eyes destitute of the third lid; skin covered with imbricate scales or plates; feet none; chest and blade-bones wanting; ribs encircling the body; body of the vertebra uniting by a convex and a concave surface; the os tympanum or pedicel of the lower jaw moveable, and suspended to another similar bone or mastoid, attached to the skull only by ligaments. The branches of the jaw only united together by ligaments, so as to let them separate more or less from each other, and allow the animal to swallow large bodies; the palatine arches moveable, armed with sharp recurved teeth.

§ I. *Upper jaws with fangs only.* Venati. (Venenati must be meant.)

Families: 1. *Crotalidæ*. 2. *Viperidæ*.

§ II. *Upper jaw with teeth, and with or without fangs; oviparous.*

Families: 3. *Hydridæ*. 4. *Colubridæ*. 5. *Boïdæ*.

Order V. *Chelonii*. (Testudinata, Oppel.)

Body short, enclosed between two horizontal shields, with the head, neck, tail, and four legs, passing out between; mouth toothless, often covered with a horny bill; tongue short.

§ I. *Feet and head retractile into the carapace; carapace solid, covered with horny scales.* Cryptopodi.

Families: 1. *Testudinidæ*. 2. *Emydidæ*, Bell.

§ II. *Feet and head not or only partly retractile into the carapace; carapace mostly soft.* Gymnopodi.

Families: 3. *Trionycidæ*. 4. *Sphargidæ*. 5. *Cheloniadæ*.

Our limits have compelled us to confine ourselves to the orders and families: the subfamilies, the genera, and their subdivisions as marked out by Mr. Gray will be given under their respective heads.

The following table of the affinity of Reptiles is given by this zoologist:—

Normal Groups.	*Annectant Groups.*
Order I.—*Sauri*.	
1. Stellionidæ.	3. Lacertinidæ.
2. Geckotidæ.	4. Chamæleonidæ.
	5. Tupinambidæ.
Order II.—*Emydosauri*.	
1. Crocodilidæ.	3. Plesiosauridæ.
2. ———	4. Ichthyosauridæ.
	5. ———
Order III.—*Chelonii*.	
1. Testudinidæ.	3. Trionycidæ.
2. Emydidæ.	4. Sphargidæ.
	5. Carettidæ (Cheloniadæ?).
Order IV.—*Ophidii*.	
1. Crotalidæ.	3. Hydridæ.
2. Viperidæ.	4. Colubridæ.
	5. Boidæ.
Order V.—*Saurophidii*.	
1. Scincidæ.	3. Typhlopsidæ.
2. Anguidæ.	4. Amphisbænidæ.
	5. Chalcidæ.

The class *Amphibia* are thus defined:—Body with a soft naked skin; heart with one auricle and one ventricle; respiring by lungs and gills, and often by lungs only when perfect; claws none; head articulative to the vertebra by two condyles. Blood cold; windpipe membranaceous; ribs none, or very short and imperfect; egg-skin membranaceous. Animal often changes its form and habit during growth; eggs fecundated after they are deposited, hatched in the water where they are laid. They do not only differ from the perfect animal by having gills, but they often change their external and internal conformation, and generally gain legs.

The following are the orders and families under which Mr. Gray arranges the genera:—

§ I. *Undergoing transformation; gills deciduous; eyelids three, distinct; spiracles none.* Mutabilia, Gray. The larva elongated, respiring by deciduous gills.

Order I. *Anoura*, Dum, (Salientia, Laur.; Batrachians, Blainv.).

Families: 1. *Ranidæ* (subfamilies *Hylina*, *Ranina*, *Bombinatorina*), *Piprina* (Pipina ?), *Bufonina*.

Order II. *Urodela*, Dum. (Caudata, Oppel.; Pseudosaurii, Blainv.).

Family: 2. *Salamandridæ*.

§ II. *Not undergoing any transformation; gill none or permanent; eylids two; spiracles distinct.* Amphipneusta.

Order III. (Sirenes, Linn.)

Families: 3. *Sirenidæ* (subfamilies *Proteina*, *Serenina*, (Sirenina?). 4. *Amphiumidæ*.

Order IV. (Apoda, Merrem; Pseudophidii, Blainv.)

Family: 5. *Cæciliadæ*.

In 1831 the same author published, in Griffith's Cuvier (vol. ix.), a 'Synopsis of the Species of Reptiles,' in which he made some alterations in his first classification. He there places the order Testudinata in the first section (*Cataphracta*), and distributes the genera nearly in the same manner adopted by him in his separate publication, 'Synopsis Reptilium,' where he particularly treats of the *Chelonians*. In the second section (*Squamata*) he arranges the Saurians, Ophisaurians, and Serpents.

For the Saurians he adopts Wagler's divisions, depending on the form of the tongue and the manner in which the teeth are placed in the jaws.

The *Amphibia* are still classed separately: in the second section (*Amphipneusta*), which undergoes no metamorphosis, are placed the *Protei*, comprehending *Hypochton*, *Menobranchus*, *Phyllidra*, or *Siredon*, *Siren*, to which Mr. Gray approximates the *Pseudobranchians*, *Amphiuma*, to which he approximates the *Abranchians* (*Protonopsis*, Barton), and the *Cæciliæ* (*Siphonops*, Wagler; *Ichthyophis*, Fitzing; and *Epicrium*, Wagler).

In the *Synopsis of the Contents of the British Museum* (1840), Mr. Gray has again considerably modified his method, and, as we think, improved it. The *Reptilia* forming the third class are thus arranged.

§ I. Squamata.

Order I. Sauria.

A. *Leptoglossæ*.

Families: 1. *Monitoridæ*. 2. *Helodermidæ*. 3. *Teidæ*. 4. *Lacertinidæ*. 5. *Zonuridæ*. 6. *Cercosauridæ*. 7. *Chirocolidæ*. 8. *Chamæsauridæ*. 9. *Chalcidæ*. 10. *Scincidæ*. 11. *Gymnophthalmidæ*. 12. *Pygopidæ*. 13. *Rhodonidæ*. 14. *Acontiadæ*. 15. *Typhlopsidæ*.

B. *Pachyglossæ*.

Families: 16. *Geckotidæ*. 17. *Iguanidæ*. 18. *Agamidæ*. 19. *Chamæleonidæ*.

Order II. Ophidia.

A. *Venenosa*.

Families: 1. *Crotalidæ*. 2. *Viperidæ*.

B. *Innocua*.

Families: 3. *Colubridæ*. 4. *Boidæ*. 5. *Hydridæ*.

§ II. Cataphracta.

Order III. Chelonia.

Families: 1. *Testudinidæ*. 2. *Emydæ*. 3. *Chelydæ*. 4. *Trionycidæ*. 5. *Cheloniadæ*.

Order IV. Emydosauri.

Family: *Crocodilidæ*.

Order V. Amphisbænia.

Families: 1. *Trogonophidæ*. 2. *Chirotidæ*. 3. *Amphisbænadæ*.

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* Common to Reptiles generally; as well as to other animals which have an *os quadratum*.

With the exception of the Paris collection, that of the British Museum is more rich in *Reptilia* than any other public or private museum.

MM. Carus and Ficinus have, in their zoological arrangement, adopted very nearly the classification of Merrem and the principles of Oken for the Reptiles.

In the method proposed by Dr. Harlan, in the 'Journal of the Academy of Natural Sciences of Philadelphia,' he adopts the four orders of *Batrachians*, *Ophidians*, *Saurians*, and *Chelonians*.

The Batrachians are divided into three sections, or suborders, according to the respiratory functions. In the first suborder the opercula are indicated by a slit in the cuticle, as in *Amphiuma* and *Menopoma*. In the second division the persistent branchiæ are present, and there are many slits in the skin of the neck; this division includes *Siren* (3 species) and *Menobranchus* (2 species). In the third the species have lungs only in the adult state, so that the branchiæ and their slits disappear; the tail is persistent, and there are teeth in both jaws (*Salamandra*, *Triton*, *Frogs*, and *Toads*).

In the dichotomous or binary method proposed by Mr. Haworth (*Philosophical Magazine*), there is little more to be observed than that the labours of preceding writers, especially Merrem, are carried out in it, as indeed he himself allows.

The 'Neue Classification der Reptilien' of Fitzinger was published at Vienna, in 1826. This work, the result of much anatomical and physiological study, has always held a prominent place in the history of Herpetology, and its leading principles will be seen in the following table:—

CLASSES.	ORDERS.	TRIBES.	FAMILIES.
REPTILIA.	Monopnoa.	I. Testudinata . .	1. Carettoides. 2. Testudinoides. 3. Emydoides. 4. Chelydoides. 5. Trionychoides.
		II. Loricata.	6. Ichthyosauroides. 7. Crocodiloides.
		III. Squammata . .	8. Ascalabotoides. 9. Chamæleonides. 10. Pneustoides. 11. Draconoides. 12. Agamoides. 13. Cordyloides. 14. Tachydromoides. 15. Ophisauroides 16. Chalcidoides. 17. Ameivoides. 18. Lacertoides. 19. Scincoides. 20. Anguinoides. 21. Amphisbænoides. 22. Typhlopoides. 23. Gymnopthalmoides. 24. Ilysioides. 25. Pythonoides. 26. Colubroides. 27. Bungaroides. 28. Viperoides. 29. Crotaloides. (*Saurians* and *Ophidians*.)
		IV. Nuda .	30. Cæcilioides.
	Dipnoa . .	V. Mutabilia	31. Ranoides. 32. Bufonoides. 33. Bombinatoroides. 34. Pipoides. 35. Salamandroides.
		VI. Immutabilia . .	36. Cryptobranchoides. 37. Phanerobranchoides.

In 1828, Ritgen's classification of Reptiles appeared in the 'Nova Acta Nat. Cur.,' to which we refer those of our readers who may wish to consult it. This classification is not much attended to. Not that it is inexact, but the author crowds particulars under one general denomination to excess; and his nomenclature is absolutely forbidding. The words *Chersopholidophides*, *Hydropholidophides*, and *Cacopholidophides*, used to designate groups of Serpents; and *Bdallipodobatrachians*, *Phyllopodobatrachians*, and *Didactylobatrachians*, to distinguish groups of Frogs and Toads, may be taken as examples of the terms fabricated by Ritgen, and he uses some still less euphonous.[*]

Wagler, whose early and violent death deprived zoological science of one of its brightest ornaments, published his 'Naturalisches System der Amphibien,' founded upon the organisation of the animals, at Munich, in 1830.

In this system the *Amphibia* consist of eight orders:— I. The Tortoises. II. The Crocodiles. III. The Lizards. IV. The Serpents. V. The Orvets. VI. The Cæciliæ. VII. The Frogs; and VIII. The Ichthyodes.

The *Tortoises* (*Testudines*) consist of but one family, *Hedræoglossæ*, having the tongue attached to the whole concavity of the jaw, which comprises three tribes, distinguished by the structure of the feet. 1, *Oiacopods*, or those with fin-shaped feet; 2, *Steganopods*, or those with moveable toes, united by a loose membrane; and 3, the *Tylopods*, or those whose toes are immoveable, of the same length, and enveloped in the skin of the feet.

II. The *Crocodiles* consist of the Caimans (*Champsa*), the true Croocodiles (*Crocodilus*), and the Gavials (*Ramphostoma*); and here he would place the fossil genera *Teleosaurus*, *Steneosaurus*, *Saurocephalus*,[*] and *Phytosaurus*.

III. The *Lizards*. These consist of four families: 1, the *Platyglossæ*, or those whose tongue is fleshy, flat, and free at the top; 2, *Pachyglossæ*, those whose tongue is thick and nearly entirely adherent to the concavity of the jaw; 3, *Antarchoglossæ*, whose tongue is slender, free, and extensile, but is not enclosed in a sheath at its base; 4, *Thecoglossæ*, whose exsertile tongue enters at its base into a kind of sheath.

The genera belonging to this order are extremely numerous, and some of the families are divided into tribes according to the form of the body, or the manner in which the teeth are disposed upon the edges of the jaws.

IV. The *Serpents*, consisting but of one family, comprise ninety-seven genera.

V. The *Orvets* (*Anguis*), consisting but of one family, comprehend the genera *Acontias*, *Chirotes*, *Chalcis*, *Lepidosternon*, *Amphisbæna*, and *Blanus*.

VI. The *Cæciliæ*, consisting also but of one family (*Hedræoglossæ*), comprise the genera *Siphonops*, *Cæcilia*, and *Epicrium*).

VII. The *Ranæ* are divided into two familes, the *Aglossæ* and the *Phaneroglossæ*.

VIII. The *Ichthyodes*, comprehending but one family *Hedræoglossæ*) consist of the genera *Amphiuma*, *Siredon* (Axolotl), *Hypocthon* (Proteus), *Necturus*, *Menobranchus*, and *Siren*.

In 1832, Professor Müller of Bonn published his *Beiträge fur Anatomie und Naturgeschichte der Amphibien*. (*Zeitschrift für Physiologie von Tiedemann und Treviranus*, Heidelberg). Much interesting detail relating to the history of reptiles is here entered into, but the Professor treats more especially of the *Batrachians* and *Serpents*. He divides the *Amphibia* into two great orders, consisting of the *scaly* and the *naked*.

Scaly Amphibia.	*Naked Amphibia.*
Occipital condyle simple	Occipital condyle double.
True ribs . .	None or rudimental.
Auricle of the heart double . . .	Single.[†]
Internal ear with round and oval fenestræ .	Oval only.
With a distinct cochlea	None.
Penis of the males simple or double .	None.
No metamorphosis .	Most frequently a distinct metamorphosis.
No branchiæ . .	Distinct branchiæ, or with persistent or not permanent holes.
Skin scaly, scutcheoned or cuirassed .	Naked.

Professor Müller divides the *Serpents* in accordance with their anatomical structure.

The *Microstomes*, or those which have a not dilatable mouth, correspond very nearly to the *Homoderms* of M. Duméril. They are separated into four families: 1, the *Amphisbænoids*; 2, the *Typhlopins*; 3, the *Uropeltaceans*; 4, the *Tortricins*.

The second suborder (*Macrostomes*) corresponds with the *Heteroderms* of M. Duméril. These are divided into seven families: 1, the *Oligodonts*; 2, the *Holodonts* (*Python*, &c.); 3, the *Isodonts* (*Boa*, *Pseudoboa*, &c.); 4, the *Heterodonts*, (*Dendrophis*, *Coronella*, &c.); 5, *Amphiboles* (*Dryophis*, *Dipsas*, &c.); 6, the *Antiochalinans* (*Bongarus*, *Naja*, &c.); and 7, the serpents with three sorts of teeth, and in which all the mandibular teeth are perforated and venomous (*Elaps*, *Scytale*, *Crotalus*, &c.).

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[*] It is said that Ritgen meant this essay as a sly satire on the increasing cacophony of naturalists; if so, it seems to have been a perilous joke, of which those who conduct the 'Nova Acta never dreamed; for they printed it in earnest, and so it has been received by zoologists.

[*] This is a sauroid fish.

[†] Davy, 'Edinburgh new Philosophical Journal,' 1828, discovered the double auricle in the Toad and Frog; and he is confirmed by Martin Saint-Ange, and Weber. Professor Owen has shown that though the auricle in the Siren appears simple, it is in fact separated into two by a complete septum.

The work is well illustrated, especially with good osteological and other anatomical figures.

In 1833, the first part of Schinz's *Naturgeschichte und Abbildungen der Reptilien* was published at Leipzic: in 1834 it was concluded. It brings down the information to the time of its publication, is well digested and well illustrated with coloured figures of the true reptiles and amphibians, mostly from good originals, but some from nature, and will be found very useful, especially as a book of reference.

Mr. Swainson (*Natural History of Fishes, Amphibians, and Reptiles*, in Lardner's *Cyclopædia*) places the *Amphibia* and the *Reptilia* in different classes.

He gives the following as 'a natural arrangement of the class of amphibia, according to Professor Bell:'—

Order I. Amphipneura (Amphipneusta?) (*Proteus, Siredon, Menobranchus, Siren, Pseudobranchus*). Order II. Anoura (Frogs and Toads). Order III. Urodela (*Salamandrina, Salamandra, Tritonella, Molge*). Order IV. Abranchia (*Menopoma, Amphiuma*). Order V. Apoda (*Cæcilia*).

The same author gives the following as a 'Synopsis and Natural Arrangement of the Class of Reptilia:'—

Order I. Emydosaures—*Crocodiles* (*Crocodilus, Champsa, Stenosaurus*). Order II. Chelonides—*Tortoises* (Families: Chelidridæ, *Crocodile Tortoises*; Testudinidæ, *Land Tortoises*; Emydæ, *River Tortoises*; Trionycidæ, *Soft Tortoises*; and Chelonidæ, *Sea Turtles*). Order III. Elanosaures (Enaliosaurs?)—*Fish Lizards* (*Plesiosaures, Icthyosaures, Saurocephalus, Pterodactylus*). Order IV. Ophides—*The Serpents* (Families: Hydrophidæ, *Water Serpents*; Crotalidæ, *Poisonous Serpents*; Coluberidæ, *Snakes not poisonous*; Anguidæ, *Slow-Worms*; and Amphisbænidæ, *Blind-Worms*). Order V. Saures—*The Lizards* (Families: Chamæleonidæ; Iguanidæ, *Thick-Tongued Lizards*; Lacertidæ, *Slender-Tongued Lizards*; Agamidæ; and Scincoidæ.

In the same year Professor Bell published his interesting *History of British Reptiles*. He considers the *Reptilia* and *Amphibia* as distinct classes, and justifies his opinion by a reference to their characters, which appear to him to be sufficiently marked and important to warrant their separation.

The Reptiles considered in Mr. Bell's history are necessarily limited, and the families *Cheloniadæ, Lacertidæ, Anguidæ, Colubridæ*, and *Viperidæ* are the only groups noticed. But, in his *Introduction*, the author delivers an opinion which, from his acknowledged skill in this branch of natural history, is worthy of all respect, and which is decidedly adverse to what has been called the Quinary system, a system regarded with an unfavourable eye by Continental zoologists generally, and by many in our own islands. 'Those,' says Professor Bell, 'who have made the most philosophical attempts to ascertain the natural system, the grand and harmonious plan upon which all organic creation is believed to have been formed, have concurred in considering the *Reptilia* as constituting a group of equal value in the vertebrate division of the animal kingdom with the *Mammalia* and *Birds*. It may be safely predicated that, if the system to which I more particularly refer be true, all the groups of equal rank must be founded upon characters of equal value and importance. That if, for instance, the group of Mammalia and that of Birds be equal to each other, each of the other classes—that is to say, every other group of the same rank—must be equal to each other; and also, that the subordinate groups in each of these classes must exhibit the same mutual relations in every case. But if it can be shown that in one class so called two *ordinal* groups exhibit as great a discrepancy in their relative plan of organization as any two classes do, then the relation of the former to either of the latter is not and cannot be the same as that which exists between the latter two. Yet in this predicament stand the three first classes of the *Vertebrata*, the relation of the *Mammalia* and *Birds* being much stronger and more obvious than those of the *Reptilia* to either, and the two groups of the latter which I have just sketched, the *Tortoises* and the *Serpents*, being nearly or quite as far removed by their structure from each other as the *Birds* are from the *Mammalia*. The mode of reproduction is the sole exception of consequence to this view of their relations; and here we have, on the other hand, a close approximation between the *Reptilia* and the *Birds* themselves.

'These considerations appear to me to exhibit insurmountable objections to the consistency and unity of the Quinary arrangement, as representing a uniform and perfect plan or system upon which the animal kingdom was created; and I cannot believe that the occasional occurrence of even striking and important coincidences, which appear on a partial view to prove its truth, are sufficient to counterbalance the evidence of its inconsistency which I have just adduced.'

But the Professor, not without reason, as it appears to us, goes further. 'The relations of these groups' (he has been contrasting the widely different forms in some of the groups of Reptiles) 'seem almost to set all the established principles of classification at defiance; nor is there any one system hitherto promulgated which appears to me satisfactorily to solve the difficulty.'

Professor Bell thus arranges the class *Amphibia*:—

Order I. Anoura (*Rana, Hyla, Bufo*, &c.). Order II. Urodela (*Salamandrina, Salamandra, Molge*). Order III. Amphipneusta (*Proteus, Siren, Menobranchus*, &c.). Order IV. Abranchia (*Menopoma, Amphiuma*, &c.). Order V. Apoda (*Cæcilia*).

Mr. Bell states that he does not offer this arrangement either as wholly original or as absolutely natural; but he adds, that it appears to him to be less objectionable than the others which have been proposed.

We confess that, after some consideration and examination, we do not think that the organic differences between the true *Reptiles* and the *Amphibia*, as they are termed, are sufficient to warrant a separation into two distinct classes. The *Amphibia* may be considered as a division or subclass; but it is too much, in our opinion, to say that a Salamander (*Salamandra*) and a Sand Lizard (*Lacerta agilis*) belong to different *classes*.

ORGANIZATION.

Motility.—The motion of *Reptiles* is as various as their structure, and exhibits a great diversity, particularly in the modes of progression. The slow march of the Land Tortoise, the paddling of the *Turtles*, the swimming and walking of the Crocodiles, the Newts, and the Protei, the agility of the Lizards, the rapid serpentine advance of the Snakes, the leaping of the Frogs, offer a widely extended scale of motion. If we add the vaulting of the Dragons and the flying of the Pterodactyles, there is hardly any mode of animal progression which is not to be found among the Reptiles.

Sensibility.—The senses in general are well developed in this class. Touch, taste, smell, hearing, and sight are present in a degree in all, though much more highly developed in some than in others. In *Typhlops*, for instance, the eyes are hardly visible, and in *Proteus* the development of the organ of sight appears to be at its minimum. The Lizards, Serpents generally, and Frogs, are very quick-sighted.*

Respiration.—The aëration of the blood is effected variously, either by lungs or gills, but by lungs principally, according to the condition of the Reptile or Amphibian. In the terrestrial Reptiles the air is, so to speak, swallowed, and in some an absorption of air as well as water (in the *Frogs*, for instance) takes place through the skin.

Nutrition; Reproduction of Injured Parts.—Digestion is performed very slowly, and the animals of this class are capable of very long fasts. In many, parts, when injured or entirely removed, are reproduced. In the Newts, for instance, an entire limb and even an eye has been replaced by the resources of the animal.

Generation.—The Reptiles are generally oviparous; but in some cases, those of the Viper, the Slow-Worm, the viviparous Lizard (*Zootoca vivipara*), for instance, they are ovoviviparous. In some, again, as in the Frogs, there is no intromittent male organ; in others, as in the Tortoises and Serpents, the intromittent organ is of considerable size.

Skeleton.—The skeleton of Reptiles is as variable as the very variable forms of the animals themselves. In some, the Crocodile for instance, the skull is a solid bony mass; in others, to take a Python or a Boa for instance, the cranium is composed of a great number of pieces so adapted as to admit of dislocation for the purpose of aiding in the dilatation of parts to facilitate the deglutition of a disproportioned prey. In some the ribs are so highly developed as to become organs of motion (the Serpents); in others (the Frogs), the ribs are entirely absent or rudimental. In some there is not only a true sternum, but also a sort of abdominal sternum, apparently produced by the ossification of the tendinous portions of the recti muscles (Crocodiles). In others there is no sternum at all, though the ribs are well developed (Chamæleons). In some there are four well developed anterior and posterior extremities (Tortoises and Saurians); in others only two, and those not well developed (Chirotes, Bipes); in others none whatever (some of the Ophidians).

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* Excepting in the case of the serpents, a short time before the moult, or change of skin.

The leading differences in the organization of these animals are indicated under the articles, treating of them in this work; but in the bones of all of them, whether true *Reptiles* or *Amphibia*, there is a peculiarity of character which enables the skilful comparative anatomist to pronounce at once that a bone is or is not the bone of a Reptile. This is of no small consequence, for it has enabled men so skilled to determine the class to which some of the most interesting and wonderful organic remains detected by the geologist and palæontologist belong.

Fossil Reptiles.

Of all the animals which the wrecks of a former world contain, none exhibit more striking, more gigantic proportions than the fossil Reptiles. As far as this work has hitherto gone, we have endeavoured to make some of these forms familiar to our readers [Ichthyosaurus; Iguanodon; Megalosaurus; Plesiosaurus; Pterodactyle; &c.]; and we shall continue to add any that may in future claim attention. We shall here merely remark, that there is reason for believing that Batrachians of gigantic dimensions once inhabited our planet.

REPUBLIC is derived immediately from the French *république*, and ultimately from the Latin *res publica*. The Latin expression *res publica* is defined, by Facciolati, to be 'res communis et publica civium una viventium,' and corresponds very closely with the English word *commonwealth*, as used in its largest acceptation for a political society. The Latin word *res publica* might be applied to a community under a monarchical government; thus Augustus is said, in a passage of Capito, a Roman lawyer, to have governed the *res publica* (Gellius, xiii. 12); the word however was more applicable to a society having a popular government than to a society having a monarchical government; thus Cicero denies that the name of *res publica* can be properly given to a community which is grievously oppressed by the rule of a single man: 'Ergo illam rem populi, id est rem publicam, quis diceret tum, quum crudelitate unius oppressi essent universi; neque esset unum vinculum juris, nec consensus ac societas coetus, quod est populus' (*De Rep.*, iii. 31).

A *republic*, according to the modern usage of the word, signifies a political community which is not under monarchical government, or, in other words, a political community in which one person does not possess the entire sovereign power. Dr. Johnson, in his dictionary, defines a republic to be 'a state in which the power is lodged in more than one.' Since a republic is a political community in which several persons share the sovereign power, it comprehends the two classes of aristocracies and democracies, the differences between which are explained under Aristocracy and Democracy.

The word *republic* is sometimes understood to be equivalent to *democracy*, and the word *republican* is considered as equivalent to *democrat;* but this restricted sense of the words appears to be inaccurate; for aristocratic communities, such as Sparta, Rome in early times, and Venice, have always been called republics.

It has been shown in Monarchy that the governments usually styled 'limited monarchies' are properly aristocracies presided over by a king; and consequently ought to be referred to the class of republics, and not to that of monarchies, in which they are commonly placed. We observe however that the German writers, who know from their personal experience the character of monarchies strictly so called, sometimes correctly give the name of republican to the government of England since 1688, and to the government of France since 1815.

A vast deal of error and confusion of thought (leading to important practical consequences) has arisen from the capricious and indistinct usage of the words *monarchy* and *republic*.

REPUBLICATION. [Will.]

REPULSION is that power by which bodies or the particles of bodies are made to recede from one another. Both attraction and repulsion exist in all the particles of material substances, and seem to be properties by which those particles act upon one another when not in contact. The cause of these actions will probably be for ever unknown to us, and the terms are only applied in conformity to the phenomena exhibited. At all sensible distances, bodies, small and great, except in certain states with respect to electricity or magnetism, attract one another; and the intensity of the attraction varies inversely as the square of the distance between the bodies. But the phenomena of light and of elasticity in general, show that at distances which are not appreciable by the eye (perhaps such as are less than $\frac{1}{5000}$ inch) both attractions and repulsions take place.

In his researches concerning the phenomena of light, Newton, having brought at one time a hair, and at another the edge of a knife, near a small beam of light in a darkened room, found that the particles of light were made to deviate from the rectilinear direction, as if attracted by a force which diminished with the distance of the ray from the hair or knife. The shadow of the latter was bordered with three coloured fringes, of which the nearest to it was formed by inflected rays passing at a distance rather greater than $\frac{1}{800}$ inch from the knife-edge; and the second and third fringes by rays inflected respectively at greater distances. (*Optices*, lib. iii.) From these phenomena Newton was led to the opinion (which he proposes as a query) that all material bodies might be assemblages of particles in equilibrio between their mutual attractions and repulsions. He imagined also that a subtle æther, pervading material bodies, was the immediate agent in producing such attractions or repulsions, together with all the circumstances of cohesion, and also those of chemical, magnetical, and electrical actions. The phenomena of nature seem to justify the supposition that an æther pervades all bodies; but it must be admitted that the hypothesis of Newton only removes the difficulty concerning the actions of the particles of bodies a step further, since we are equally at a loss to account for the existence of the powers in those particles, and in the æther itself.

The reality of a distance between the particles of bodies, whether solid, fluid, or gaseous, admits of no question; for the differences in the densities of these classes of bodies can only be conceived to arise from the different extent of the intervals between the particles. By the process of cooling, all bodies, with certain exceptions in particular cases, become contracted in volume; and the mixing of two given volumes of different fluids (as water and sulphuric acid) produces a volume less than the sum of the two separate volumes. These effects manifestly depend upon the approach of the particles to one another, and are therefore inconsistent with the supposition that they were originally in contact.

It is natural to ask if there be such a thing as mathematical contact in nature, and it may be answered that we have no evidence of such a condition. [Cohesion.] Besides the continual diminution of volume produced in the cooling of bodies, the Newtonian experiment of pressing a convex lens of glass upon the surface of a glass mirror affords evidence that the lens, at the point of nearest approach, and under a very great pressure, is not in contact with the mirror; and it has been supposed that the distance between them, at that place, is then not less than $\frac{1}{100000}$ inch. (Robison, *Mechan. Phil.*) It seems to follow that a vast force of repulsion must be in action between the particles of bodies when they are as near together as mechanical power can bring them; and it can be easily conceived that such repulsive force may be the immediate cause of the sensation of touch.

It has been said that the mixture of certain different fluids produces a diminution of volume, but it must be observed that a contrary effect frequently takes place. Some of the metals, when mixed together in a melted state, produce a volume greater than the sum of the component volumes; and melted metals, on becoming solid, like water on being frozen, expand in volume. The latter effect may arise from the crystals, on being formed, placing themselves across one another so as to leave comparatively large intervals; but the other can only be caused either by a diminution of the attractive power which the particles exert on one another, or by its being changed into a power of repulsion. One of these latter circumstances must also be the cause of the great augmentation of volume which takes place when the components of some bodies are disengaged from each other. It is said that if the parts of an olefiant gas were separated, the sum of the separate volumes would be four times as great as the volume of the compound. (Turner, *Elements of Chemistry*.)

It is right to observe that the word repulsion is often applied to phenomena which are in reality the results of attraction. A small quantity of quicksilver being laid on a glass plate assumes a spherical form, instead of spreading over it in a thin surface; and this was once supposed to arise from a repulsive power in the glass, whereas it is owing to the attraction of the particles of quicksilver for one another being greater than the attraction of the glass for the quicksilver. Again, when a small sewing-needle is placed on the surface of water, it remains there without sinking, and the water is depressed about the needle as if it were repelled by the steel; in fact however the trough is caused by the weight of the needle, which displaces the particles of water, but is not great enough to overcome their attraction for each other. Also, when two balls, one of them of glass, which is capable of attracting water, and the other of burnt cork, which is not, or only in a very small degree, are placed near one another in water, the latter seems to be repelled from the former; but the cause of the phenomenon is that the ring of elevated water about the glass assumes on the exterior a conical surface, so that when the cork ball is brought near enough to the other to be partly on the slope, it immediately slides off by its gravity.

The elasticity of bodies is a result either of attractive or repulsive powers, or both. For example, when a steel rod is bent, the particles on one side will be forced towards, and on the opposite they will be drawn from one another; in recovering itself, a force of attraction will be exerted on the latter side, and of repulsion on the other; and this may be considered as an evidence that in the insensible spaces between the particles of bodies attractions and repulsions prevail according as the distances between those particles are varied. While the change of figure in the rod is small, so that the displacement of any two particles is but a small part of their whole distance from one another, the attractions and repulsions exerted by the force applied are proportional to that force; and upon this principle depends the observed isochronism in the oscillations of a watch-balance, whatever be the extent of the arcs of vibration. The expansions of solids and fluids by heat, and the elastic powers of gas at different temperatures, are consequences of the repulsions residing in the particles of caloric, or induced by the latter in those of the bodies with which they are combined. [Elasticity; Gas; Heat.] The repulsive power existing in the air which is condensed in nitre, produces, on being combined with heat, a velocity of expansion equal to about 7000 feet per second; and the force of pressure resulting from it is thought to be equal to 2000 times the pressure of the atmosphere. (Hutton, *Tracts*.) The repulsive force which produces some of the electric explosions in the atmosphere is supposed to be much greater. But the forces both of attraction and repulsion by which the particles of light are deflected from their course when they impinge on a refracting or reflecting surface are enormous; and Sir John Herschel computes that they exceed the force of gravity in the ratio of 2×10^{44} to 1. This is on the hypothesis of radiation; and that philosopher observes that on the undulatory hypothesis the numbers are equally high.

The circumstances of electrical attractions and repulsions are shown in the article Electricity; and the results of experiments prove that the intensities of these forces in the electric, galvanic, and magnetic fluids, like that of general attraction, vary inversely as the squares of the distances of the bodies.

Boscovich has ingeniously represented the series of alternate attractions and repulsions supposed to be experienced by a particle of matter within the very small distances between that particle and another, by a curve consisting of several bends crossing and recrossing an axis in points at various distances from the origin, which may be supposed to be the place of the second particle above mentioned. The ordinates of this curve on one side of the axis represent attractions, and those on the other side repulsions; the places of crossing being supposed to be those at which the first particle would be at rest. Beyond the small distance above mentioned, this axis becomes an asymptote to the curve, and the ordinates of the curve here represent the general law of attraction (the inverse square of the distances). Near the origin of the axis the ordinates represent repulsions; and these ordinates constantly increase till they become infinite, so that a right line drawn through the place of the second particle, perpendicular to the axis, is an asymptote to this branch of the curve.

REQUEST, COURTS OF (sometimes called *Courts of Conscience*), are local tribunals, founded by act of parliament to facilitate the recovery of small debts from any inhabitant or trader in the district defined by the act.

As all the acts are made upon the same model, the most easy method of explaining the functions of these courts will be to show the general provisions of those acts.

In the first place a board of commissioners is appointed, often in corporate towns consisting of one or two alder men, with a certain number of householders as assessors To this board is given the power of summoning a debtor, upon the complaint of the creditor, of taking the evidence of the creditor and his witnesses upon oath, of determining on the amount due, and issuing a summons or order to the debtor to pay that amount, either in one sum or by instalments. Finally, they have usually the power of distress on goods, or of imprisonment during a limited time, if their order for payment is not obeyed. In London their jurisdiction is confined to cases where both parties are inhabitants, and the same restriction may be found in some of the older acts; but usually it is sufficient that the debtor should be an inhabitant, or should be 'seeking his livelihood' within the jurisdiction.

The sum to which the jurisdiction of these courts extends is usually 5*l*., often only 2*l*. (in London and Bath it is 10*l*.), and the debt may arise either upon simple contract, a balance of accounts, or as a compromise of a larger debt; but there is usually a proviso in the acts that a larger debt shall not be split into fragments to bring it within the jurisdiction of the court, although the creditor may reduce a larger demand to such a sum as the court can award, provided he is satisfied with the smaller amount in discharge of his whole debt.

The acts usually provide that if a party within the jurisdiction is sued in one of the superior courts, and the plaintiff recovers from him only the sum which the local court could have awarded, the plaintiff shall pay full costs to the defendant. The acts also reserve to a landlord the right to distrain for rent, and also prohibit the courts from interfering in matters touching the right to land or the occupation of it, or in matters belonging to ecclesiastical courts, or to tithes: usually, too, gambling debts are excluded, and sometimes tavern debts incurred on Sunday. The courts have jurisdiction over persons under age, and, on the other hand, can usually grant summonses for wages due to minors. Attorneys are not exempted from the jurisdiction of the court, but they are usually prohibited from practising in it, and they are not liable to payment of costs for suing in superior courts. Most of the acts contain a clause prohibiting the removing of the proceedings to superior courts.

The first Act for the establishing of a Court of Requests is the 1 James I., c. xv., confirming the court which had already been established in London by an act of the common council, at least as early as the reign of Henry VIII., if indeed it had not been established by antient usage. (Tidd Pratt's 'Abstract of the Acts of Parliament relating to Courts of Request,' for a list of the places which have such courts.)

RE'QUIEM (*Requies*, Lat., *rest*), the name of a Mass sung in the Romish Church for the repose of the dead, beginning *Requiem æternam*, and in the Roman Catholic liturgy called *Missa pro Defunctis*.

RESCRIPT. [Rome—*Roman Law*.]

RESCUE, in Law ('rescous,' from the old French word *rescourser*, 'to recover'), is the unlawful and forcible setting at liberty a person or goods then in lawful custody. A rescue may be either a criminal offence or a civil injury, according to the circumstances under which it is effected. The character of the criminal offence is determined by the character of the offence committed by the person rescued. If, for instance, a party has rescued a traitor or a felon, he has committed the offence of treason or felony; but as the treason or felony of the person rescued cannot be assumed to have been committed until after his conviction and judgment, it is not proper to arraign the rescuer for such offences until after judgment of the principal offender. But it is said that the rescuer may be indicted for a misdemeanour even before such judgment.

A rescue committed under other circumstances than those above stated is a misdemeanour.

An indictment for a rescue [illegible] the circumstances under which the person, &c. was arrested, and the rescue effected, so as to show that all things existed necessary both in fact and intention to create the offence of rescue, and to enable the offender to disprove them.

Such was the state of the common law on this subject. Many statutes have been passed, some very limited in their application, which do not materially vary the character of the offence, the proceedings, or the punishment. Of these the most important and general in their application are 25 Geo. II., c. 37, relating to the rescue of a person convicted of murder, or his body after execution; 1 & 2 Geo. IV., c. 88, which applies to persons rescuing or assisting to rescue from the lawful custody of any constable or other person whatsoever any person charged with or suspected of or committed for any felony, or on suspicion thereof, and regulates also the amount of punishment to which a rescuer is liable; and 5 Geo. IV., c. 84, relating to the rescue of prisoners sentenced to transportation, by which also it is provided that the conviction of the principal offender may be proved by a certificate from the proper officer. The stat. 6 Geo. IV., c. 5, relates to the land-forces of her majesty, and c. 6, to marines.

Previously to the abolition of arrest on mesne process (1 & 2 Vic., c. 110), if a prisoner in custody of the sheriff on mesne process was rescued, the sheriff might make a return to that effect, which freed him from further responsibility. The rescuers were liable to an attachment for a contempt, and also to an action at suit of the plaintiff. On the action it was necessary to prove the original cause of action, the writ and warrant, and the arrest. To entitle himself to damages, the plaintiff must have shown the subsequent insolvency or disappearance of the defendant. The law as to this subject is probably still the same as to those cases where under the act in question an arrest is still permitted on mesne process.

Where a party arrested on judicial process, as upon a capias ad satisfaciendum, &c., or goods taken upon a fieri facias are rescued, the sheriff cannot return that there has been a rescue, and either he or the gaoler is in all cases, except where the rescue is effected by the king's enemies, answerable in an action by the plaintiff. This liability of the sheriff is concurrent with the liability of the rescuers themselves, the plaintiff having the option to sue either the rescuers or the sheriff.

By the 2 Will. & Mary, st. 1, c. 5, upon rescue of goods distrained for rent, the person grieved may by action on the case recover treble damages and costs against the offenders or any of them, or the owner of the goods, if found to have come to his use or possession. In an action under this statute the plaintiff must show the demise, the rent in arrear, and the rescue. In all cases, in order to constitute a rescue, the arrest must be lawful. Thus, if the rent due has been tendered before the distress is made, &c., then the custody of the goods, &c. being unlawful, no rescue can be committed.

(Com., *Dig.*, 'Rescous;' Hale, *P. C.*; Hawk., *P. C.*; Russell, *On Crimes*; Matthews, *On Criminal Law*.)

RESHT. [Persia.]

RESIDUAL, an expression which gives the remainder of a subtraction, as $a-b$.

RESIDUAL PHENOMENON, a term lately brought into partial use, to signify that part of a phenomenon which is left, when every part which can be explained or accounted for is removed. This residual phenomenon [Observation] may be all the observer's error, or may be partly the effect of some undiscovered law and partly the error of the observer.

RESIDUARY LEGATEE. [Legatee.]

RESIGNATION. [Benefice.]

RESIN (*Rosin, Colophony*). [Turpentine.]

RESINA. [Naples.]

RESINS are secretions of plants, which are probably all in a fluid state; but become solid either by the evaporation of their more volatile parts, or by the absorption of oxygen. They are distinguished from true balsams by the absence of benzoic acid [Balsams], and from gum-resins [Gum-Resins] by the absence of gum, their complete insolubility in water, and their requiring alcohol for perfect solution. Some are soluble in cold alcohol, and these are termed *resins*; others are soluble only in boiling alcohol, and termed *sub-resins*; but the two are often also associated in the same substance. Many volatile oils, by long exposure to the air, or merely by a reduction of temperature, deposit a substance termed a *stearopten*, which is analogous to resin. [Camphor.] Where a considerable quantity of volatile oil coexists with a resin, a honey-like consistence is preserved, and the resin is termed *soft-resin*. When a very large portion of oil is present, a fluid condition exists, and *turpentine* is the proper designation.

Resins are the produce generally of the most complex and highly organised plants, seldom found in acrogens, except ferns, rarely in endogens, and most abundantly in certain tribes of exogens. They are mostly found in the older and permanent parts of plants, and more copiously the older the individual tree is; nevertheless they are occasionally found in herbaceous plants, and even in the most perishable parts of these. Thus the leaves of the Laretia acaulis (Selinum acaule) secrete resin, forming an exudation, and accumulating into pieces weighing from half to one drachm or more. (Meyen, *Reise*, i., p. 315.) The resins sometimes exude spontaneously; but more commonly they are procured by incisions in the bark. They are fusible at a low temperature, and inflammable, burning with a copious smoke and agreeable perfume; hence their employment as incense or to form pastiles.

Taken internally they are stimulant, promoting secretion of the skin and kidneys; externally, they are rubefacient. Some resins are dangerously caustic, such as euphorbium. The most important medicinal resins have been already treated of. [Boswellia; Elemi; Guaiacum; Mastich; Olibanum.] Several are of great utility in the arts to form varnishes. [Copal; Mastich.] A great variety of vegetable remedies are indebted for their most useful properties to the resin which they contain, in conjunction with other principles, such as jalap, scammony, &c. [Convolvulus.]

RESISTANCE is a power by which motion, or a tendency to motion, in any body is impeded or prevented. When a weight or pressure acts upon a beam or bar in any direction, the tenacity by which the particles of such material oppose that action constitutes a resistance of one kind. [Materials, Strength of.] Again, when a body is made to move on another, the inequalities of the surfaces of both create a resistance of a different kind. [Friction.] When body moves in a fluid, the inertia of the fluid particles displaced by it produces a third kind of resistance.

This last branch of the subject of resistances has already been in part considered. [Hydrodynamics, p. 393, col. 1.] In that article there is given a general expression for the measure of the resistance made by a fluid against a plane surface which is either perpendicular or inclined to the direction of the motion, together with a few results of experiments on the resistences experienced by bodies of various forms and lengths in moving through water. The relations between spaces and times in the vertical ascent and descent of bodies when acted on by gravity and resisted by a fluid are given in the article Projectiles, Theory of; and, for the pressure against a cannon-ball moving in air, see Gunnery, p. 491, col. 2.

In investigating the resistances of fluids against bodies moving in them, it is customary in elementary writings, for the sake of simplicity, to consider the particles of fluid as unconnected with each other by contact or by any law of attraction, so that, when struck, their reactions may be considered as taking place perpendicularly to the striking surface of the moving body, whatever be the position of this surface with respect to the direction of the body's motion, and after the impact their action is supposed to cease. Such are called discontinuous fluids, and in these the motion produced in the particles by the collision is the measure of the resistance. Newton shows (*Principia*, lib. ii., prop. 35) what would be the resistance experienced by a cylinder moving in the direction of its axis in a discontinuous fluid; the cylinder and particles of fluid being elastic, so that the latter on being struck are reflected back with a velocity double the velocity of the cylinder; and he explains that, if the particles of fluid are not reflected, but are moved forward by the cylinder with a velocity equal to its own, the resistance is but half the former. But this hypothesis is far from being conformable to the constitution of fluid bodies in nature, the particles of these being connected by mutual actions. The elastic fluids, as air, at any place in the atmosphere are always in a state of compression from the weight of the column vertically above that place; and the particles of non-elastic fluids, as water, exert in every direction pressures which depend upon the distances of the particles below the surfaces of the fluid in the vessel, river, or ocean. In passing through a fluid of this kind (called a continuous fluid) a body strikes only the fluid particles which are nearest to it; these strike those beyond, and so on; and Newton proves (lib. ii., prop. 35, schol.) that in this case the resistance to a cylinder is only half the last-mentioned resistance, or one-fourth of the first.

In all these resistances however it is supposed that the particles on being struck are repelled perpendicularly to the front of the moving body; but, in fact, the particles of the fluid are in part repelled from the front in oblique directions, and, on account of the compressed state of the surrounding fluid, these particles not being able immediately to escape laterally, there is produced in front more or less condensation, and consequently an increase of resistance. The pressure of the fluid against the sides of the moving body creates also a resistance from friction; and when the velocity is very great, the fluid not falling towards the hinder part of the body so fast as the latter moves, the pressure there which would serve to counterbalance the resistance in front, is in part or wholly removed. On these accounts it is that military projectiles are subject to such vast retarding forces. It is computed that a 24-pounder ball experiences a resistance equal to 800 lbs. when its velocity is equal to 2000 feet per second. Like effects take place in the movement of boats or ships; when the velocity is great, the water accumulates in front, and flowing off from thence obliquely, it carries away some from the sides, and, causing the surface of that which is near the stern to be rather lower than the general level, it there produces a diminution of pressure, while there is an excess in front on account of the accumulation.

In order to find the pressure of a fluid against a body which is terminated in front by a curve surface, an expression must be obtained (by means of the equation of the surface) for the area of an elementary portion of that surface, and this must be multiplied by the cube of the sine of its inclination to the line of motion. The product being multiplied by $\frac{v^2 D}{2g}$ [HYDRODYNAMICS], and the whole integrated between the proper limits, the result will express the required resistance.

Again, in investigating the motion of a body on an inclined plane when resisted by friction and the pressure of the atmosphere, the general equation of motion $\frac{d^2s}{dt^2} = g - a\frac{ds^2}{dt^2}$ may be employed. Here s is the space described in the time t, $\frac{ds}{dt}$ is the velocity acquired in the same time, and $\frac{d^2s}{dt^2}$ is the differential expression for accelerative or retardative force. If the body were to descend vertically, g, the force of gravity (= 32·17 feet), would alone be the force producing the motion; and the equation, being integrated, would give the relation between the spaces described and the times of description when the body descends or ascends in a resisting medium. In the first of these cases g should be positive, and in the second negative. In order to adapt the equation to the descent of a body on an inclined plane, let θ be the inclination of the plane to the horizon; then g sin. θ would represent the accelerative force on the plane if there were no friction. But since friction is proportional to the pressure (= g cos. θ) on the plane, and is independent of the velocity, let h be put for the coefficient of friction and represent a fractional part of the pressure; then we shall have hg cos. θ for the retardation produced by friction. a is the coefficient of the resistance due to the pressure of the atmosphere; it depends on the form and magnitude of the moving body, and not on its weight; and the resistance is supposed to be proportional to the square of the velocity. Thus the above equation becomes

$$\frac{d^2s}{dt^2} = g \sin. \theta - hg \cos. \theta - a\frac{ds^2}{dt^2};$$

or, since the two first terms of the second member are constant, representing them by A, it becomes $\frac{d^2s}{dt^2} = \mathrm{A} - a\frac{ds^2}{dt^2}$. Integrating this equation by successive approximations, or otherwise, we obtain in terms of t the values of $\frac{ds}{dt}$ (the velocity) and of s (the distance on the plane), either when the body sets out from a state of rest, or when it sets out with any given initial velocity. From these values, by means of the data obtained from good experiments, the values of h and a might be found; and thus the effects of friction might be obtained separately from those which are due to the resistance of the air.

In M. de Pambour's 'Practical Treatise on Locomotive Engines,' there is given, p. 154, an account of some experiments in which a number of waggons, both singly and in trains, were made, by gravity, to run down a double inclined plane; and these, since the motions were not produced by steam or any power which is liable to irregularity, appear to be the most convenient for obtaining the separate values of h and a by means of the above equation. The waggons, or the trains, set out from a state of rest at the summit, and, with the velocity acquired at the foot of the upper plane, they were allowed to run down the second, whose inclination to the horizon was very small (2′ 2″), till, by friction and the resistance of the air, the motion ceased. On making $\frac{ds}{dt} = 0$ and s, equal to the distances given by the experiments on the lower plane, the mean value of h for seven trains of waggons was found to be ·00215, or $\frac{1}{465}$ of the whole weight of a train; and that of a was ·000029. The mean value of h from the equations $\frac{ds}{dt}$ (= 0) = At + V, and $s = \frac{1}{2}\mathrm{A}t^2 + \mathrm{V}t$ (V being the velocity at the top of the lower plane): that is, its value on the supposition that it includes both friction and the resistance of the air, was found to be ·00333, or $\frac{1}{300}$ of the whole weight. Hence the resistance of the air, which is due to the mean velocities, becomes ·00118, or $\frac{1}{847}$ of the whole weight. The mean velocity may be considered as about 12 miles per hour, or 17·6 feet per second.

The above value of h and this coefficient of the square of the velocity in the term expressing the value of the air's resistance, agree very nearly with those which result from an experiment of Dr. Lardner on the Whiston plane (whose gradient is $\frac{1}{96}$), where the terminal velocity of a train, that is, the uniform velocity acquired when the resistance arising from friction and the air became equal to the force of descent on the plane, was found to be 31½ miles per hour.

The following rule for determining the gross resistance (considering the whole as due to friction) is investigated by De Pambour. 'When a body, from a state of rest, descends down two or more inclined planes till it stops by the effect of friction, the value of the friction is equal to a part of the weight of the body which is expressed by the quotient of the whole height descended vertically, divided by the whole distance passed over on the planes.' The mean resistance found by this rule for the same trains is ·00367 ($\frac{1}{273}$) of the whole weight; and the small discrepancy between this result and that which was found from the two equations above, arises from the resistance of the air being involved in the previous determination of V. It is not supposed however that the absolute values of the terms which have been obtained for the friction and the pressure of the air will serve with precision for trains of a different kind; but, till more extensive experiments have been made, they may have some utility in showing nearly the proportion between those causes of resistance.

The probability, after all, of being able to obtain general formulæ for the resistances experienced by railway trains is at present very small. The best mathematicians have long been foiled in the effort to express analytically the conditions of a very simple body (a cannon ball) moving through the air; and the problem which embraces the ever-varying circumstances attending the motion of a train of carriages is much more complex. The force with which the air acts depends on the form of the leading carriage or engine, upon the condensation of the air in front, and upon its friction along the sides of the carriages. But besides these actions, which it would be difficult to estimate, the air between every two carriages, and even in the interior of open ones, is put in motion, and produces sensible pressures against the fronts, the transverse partitions, and the interiors of the back faces. Winds blowing contrary to the direction of the motion increase the resistance to be overcome; and even those which are oblique or perpendicular to the sides, by pressing the wheels against the rails, add considerably to the friction.

In order to exhibit a comparison of the resistances experienced by a railway-train when ascending and when descending an inclined plane, we have taken the first of the examples which have been given in the table in the article **Railway**. In this the gradient is $\frac{1}{177}$, or the inclination of the plane to the horizon is 19′ 25″. The weight of the whole train being estimated at 80 tons, we have 80 × sin. 19′ 25″ = ·452 tons for the moving power of gravity in descending, or the resistance of gravity in ascending; and 80 × cos. 19′ 25″ = 79·999 tons for the constant pressure on the rails. Now the retardation from friction, both in ascending and descending, being estimated at ·00215 of the pressure by the above investigation, we have ·172 tons for the constant resistance on this account. The resistance of the air being found to be ·00118 of the pressure when the velocity is 12 miles per hour, we get ·00412 for the resistance when the velocity is 22·25 miles, and ·01423 when the velocity is 41·32 miles; and these numbers being multiplied by 79·999, give, respectively, ·33 tons and 1·138 tons, for the resistance of the air in ascending and descending.

Then, for the descending motion, subtracting from the sum of the resistances produced by friction and the air the moving-power of gravity, the remainder is 0·858 tons. And for the ascending motion, adding together all the three resistances, the sum is 0·954 tons. The difference is about $\frac{1}{10}$th of a ton, or $\frac{1}{800}$th of the whole weight, and expresses the excess of the resistance experienced by the engine in the ascent above that which it experiences in the descent. If the resistances in the ascent and descent had been computed on the supposition that the motions were affected by gravity and friction (taking the latter at $\frac{1}{300}$ of the pressure, as if it included the resistance of the air), the former being, as before, = ·452 tons, and the latter ·267 tons; the moving-power in descending would have been ·185 tons, and the resistance in ascending ·719 tons. The difference (which, in this case, is the sum) would have been ·904 tons, or nearly $\frac{1}{90}$ of the whole weight. These results will suffice to show that the diminished resistance of the air compensates, in a considerable degree, for the retardation produced by gravity when a train moves on an ascending rail; but numerous and more varied experiments must yet be made before it will be possible to determine how far it would be advantageous to use gradients instead of incurring the expense of making level lines of road.

The method of finding the resistance which an engine opposes to the effort made by the steam to put it in motion, is as follows:—Multiply the area of one of the two equal pistons in square inches by the pressure of the steam on a square inch of the piston in each cylinder, when that pressure is just sufficient to cause the engine to move; the product is the pressure on each piston. Then, since the piston makes two strokes while the wheel of the engine turns once round, the velocity of the piston is to that of the engine as twice the length of the stroke is to the circumference of the wheel; and, the resistances being inversely proportional to the velocities, we have—

circumf. of wheel : twice the length of the stroke ::
pressure on both pistons : the resistance, or inertia, of the engine.

But the resistance increases with the load which the engine has to draw; and, in order to determine it when attached to a train, the above proportion may be used; but the pressure on the pistons, instead of being found as before, must be taken when the engine and train are observed to have a uniform motion. Then the fourth term of the proportion, being diminished by the known resistance of the train, will give the resistance of the engine alone.

From the experiments of Mr. Telford, the following values of the resistances experienced by loaded carriages on level roads have been determined. On a good pavement the resistance is $\frac{1}{75}$ of the weight of the carriage and load; on a broken surface of old flint, $\frac{1}{35}$; on gravel, $\frac{1}{13}$; and on a well-constructed railway, from $\frac{1}{250}$ to $\frac{1}{280}$.

By experiments made on the force (of traction) required to give motion to vessels on canals, it is found that the resistance varies nearly as the cube of the velocity; and this great deviation from the general law of resistances is probably caused by the re-action of the sides of the canal against the water displaced by the vessel. It deserves however to be mentioned, that when the velocity of the vessel is considerable, the resistance has been found to experience some diminution, perhaps on account of the water momentarily displaced, from its inability to escape laterally, becoming condensed, and thus giving superior buoyancy to the vessel; the immersed part being less, the pressure of the water against the front will also be less.

Mr. Barlow observes that, with small velocities, the force of traction on canals is less than on railways; and when the velocity is equal to four miles per hour, the forces are equal. Beyond this velocity the advantage is in favour of the railway.

RESOLUTION. [Solution.] The resolution and solution of a question are, in common language, the same things. The word is also used as opposed to Composition.

RESOLUTION, in music, the passing of a discord into a concord. [Discord; Harmony.]

RESPIRATION, or the process of breathing, is that by which changes are effected in the common nutritive fluid of the body by its being brought into contact with the atmospheric air. It is one of the processes by which organic beings are peculiarly distinguished, and is probably carried on in some form by all of them. In the present article it will be considered only with reference to the mode in which it is performed in the animal kingdom, and particularly in man.

The common effect of the respiration of all animals is to remove some of the oxygen from the air which they breathe, and to replace it by carbonic acid gas derived from the blood. When one or more animals are enclosed successively in a vessel containing a given quantity of atmospheric air, the proportion of oxygen in it gradually decreases, till the air is no longer capable of supporting life, and the carbonic acid which is given off from the animal in place of the oxygen acts upon it as a poison. This result has often been obtained by experiments on animals, and is unhappily not unknown in the history of human suffering. In the memorable case of the Black Hole at Fort William in Calcutta, 146 persons were shut up in the evening in a dungeon measuring 18 feet by 14, and having only two small apertures for the admission of fresh air. Of the whole number, only 20 survived till the following morning. These were they who were placed nearest to the apertures: the rest were gradually suffocated by the carbonic acid, which was given off in their respiration more rapidly than the oxygen was renewed by the admission of fresh air.

Oxygen is the only gas by which respiration is supported. It is constantly supplied by the atmospheric air, of whose volume it forms a fifth part, and which is breathed in a free state by mammalia and amphibia, and in solution or mixture in water by fishes and the other truly aquatic animals. Pure oxygen however is not fit for breathing; it destroys life after a few hours, and an animal placed in it dies before it is all replaced by carbonic acid. The nitrogen of the atmosphere dilutes the oxygen to the degree which appears the best suited for respiration; and as the former gas has not its quantity materially altered by being breathed, it is probable that this dilution is the only purpose which it serves in relation to the present function.

There are three chief forms of organs for respiration: *lungs*, which are made up of branched tubes and cells placed within the body; *gills*, or *branchiæ*, which are vascular processes developed on some part of the exterior of the body; and *tracheæ*, which are tubes that ramify to extreme minuteness, and are dispersed through nearly all the organs of the body. By the first and last of these organs the free air is in almost all cases respired; by the second the air is mixed with water. The essential part of the process of respiration however is the same in all: it will therefore be unnecessary to describe here the varieties of the respiratory organs in different classes of animals, and the more so, as they have been already considered in the general description of each class and of many genera, and since the relation of each kind of organ to the circulatory system in the same class has been pointed out in the article Heart.*

In man, whose lungs may be taken as a type of those of all mammalia, they are thus formed:—The trachea, or windpipe, is a rounded tube continued from the larynx [Larynx], and commencing about an inch above the upper edge of the breast-bone. Its front and sides are chiefly composed of portions of cartilage forming about three-fourths of rings an eighth of an inch wide; and its back part consists of transverse and longitudinal fibres of elastic (and, according to some, muscular) tissue. The rings are connected by tough cellular and elastic tissues, and by numerous strong longitudinal bands; and the whole tube, as well as its farthest ramifications, is lined by a mucous membrane continued from the larynx, and covered on its free surface by a fine epithelium composed of cells with vibrating ciliæ attached to them.

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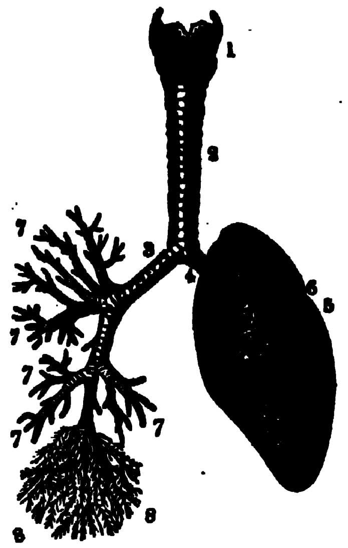
* It is almost essential to the comprehension of either, that these two articles should be read together. The writer would here also strongly recommend the reader who has not access to the parts of the human body, to examine the parts described here and in most of the anatomical articles in the bodies of some animal, especially the sheep, calf, or pig.

The trachea divides into two main branches, the bronchi, one of which goes to each lung, and in it divides into smaller and smaller branches, whose structure is in all essential respects similar to that of the trachea (*fig.* 1). Around the extremity of each of the finest branches of the bronchial tubes there are arranged a number of delicate rounded cells or vesicles, all opening into the end of the branch, but having no communication with each other. On the walls of these cells the blood circulates in the minutest capillary divisions of the pulmonary artery and veins, and it is also in these cells that the air, which is admitted to them through the bronchial tubes, comes nearly into contact with the blood. The mode in which the blood is conveyed to the lungs is detailed in the article HEART. The pulmonary artery arising from the right ventricle carries to the lungs all the blood that has been circulating through the body; one main branch goes to each lung, and, accompanying the bronchus, divides, like it, to extreme minuteness. At the last its branches terminate in the capillaries, which are arranged in the most delicate network on the walls of every pulmonary cell. Each of these cells is about $\frac{1}{70}$ of an inch in diameter; the capillary vessels are about $\frac{1}{3000}$ of an inch in diameter; and the network which they form is so close that its meshes are not more than $\frac{1}{3000}$ of an inch wide. In its passage through these the blood undergoes the changes which convert it from venous to arterial, and render it again fit for the maintenance of life. [BLOOD.] From the capillaries it passes into the pulmonary veins, and through them to the left side of the heart.

Fig. 1.

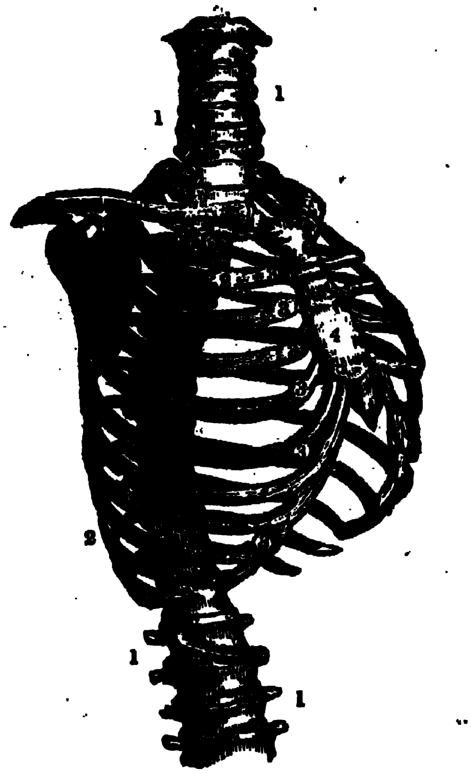


1, the larynx; 2, trachea; 3, right bronchus; 4, left bronchus; 5, left lung, the fissures denoted by the two lines which meet at 6, dividing it into two lobes, and the smaller lines on its surface marking the division of the lobes into lobules; 7, large bronchial tubes; 8, minute bronchial tubes terminating in the air-cells or vesicles.

The lungs are thus mainly composed of air-cells and of branches of the pulmonary artery and veins. Each lung is divided into two or three large portions called lobes (the right lung has almost always three lobes, the left two), each of which receives one of the main divisions of the bronchus, artery, and vein; and these are again divided into lobules, the outlines of some of which are marked by the angular figures on the surface of the lung. Lastly, the cells are grouped together in still smaller lobules not more than a quarter of an inch in diameter.

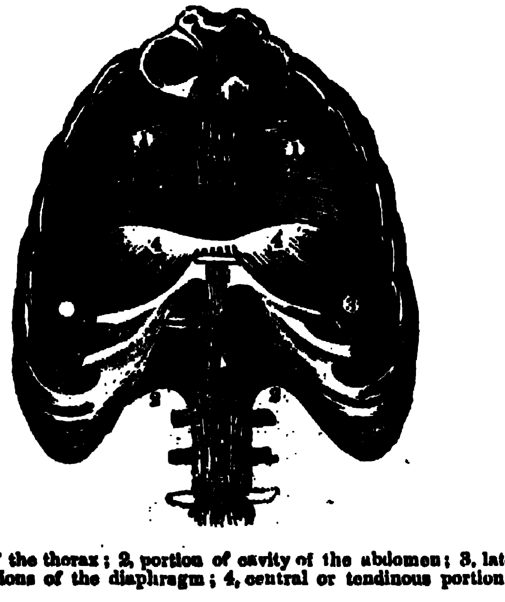
The lungs are placed in the two principal cavities of the chest. The annexed figure (*fig.* 2) represents the bony frame-work of the chest, bounded behind by the spine and the ribs as far outwards as their angles, in front by the sternum, or breast-bone, and the cartilages of the ribs, and on each side by the bodies of the twelve ribs. The space which is left below in the skeleton is, in the entire subject, filled up by the diaphragm, a large muscle represented in *fig.* 3 whose form may be roughly compared to that of the expanded part of an umbrella having its concavity downwards. The diaphragm forms a moveable partition between the cavity of the chest and that of the abdomen, permitting only the passage of certain vessels, &c. from the one to the other. By its alternate contractions and relaxations it increases and diminishes the capacity of the chest.

Fig. 2.



1, spinal column; 2, ribs; 3, cartilages of ribs; 4, sternum.

Fig. 3.

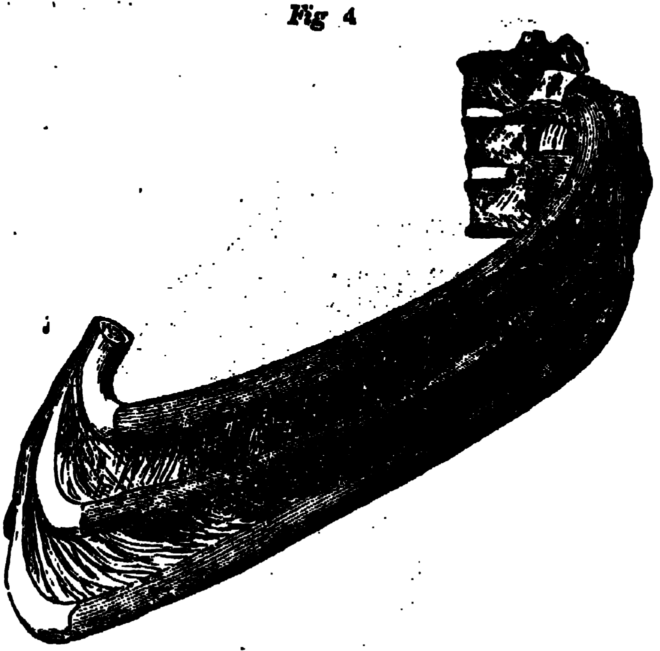


1, cavities of the thorax; 2, portion of cavity of the abdomen; 3, lateral or muscular portions of the diaphragm; 4, central or tendinous portion of the diaphragm.

The spaces between the several ribs are filled by the intercostal muscles, of which two are represented in the subjoined figure. Between each two ribs there are two layers of muscle, the fibres of each of which cross those of the other. The fibres of the outer layer, which are represented between the two upper ribs in the annexed figure, pass obliquely from above downwards, and from behind forwards; those of the inner layer, here drawn between the two lower ribs, pass with a similar obliquity from before backwards.

The upper aperture of the chest between the spine, first ribs, and sternum (*fig.* 2) is that at which the trachea passes into the chest to the lungs, and at which the great arteries of the head, neck, and arms pass out of the chest from the aorta. The spaces left between these and the bones are occupied by the œsophagus, by certain muscles

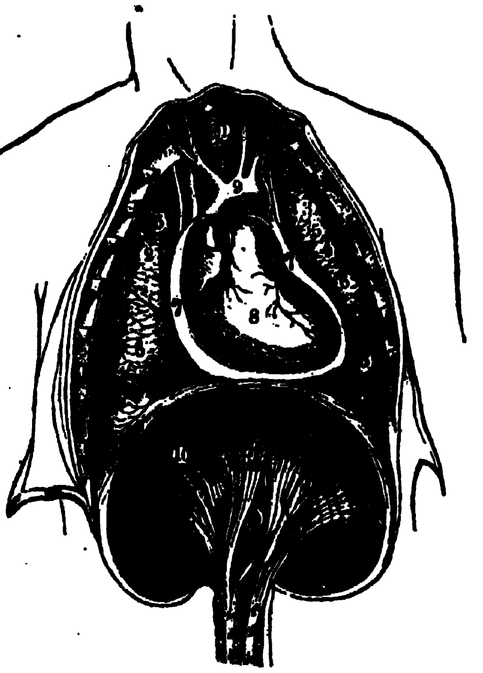
Fig 4



and nerves, by the great veins of the upper part of the body, and by cellular tissue.

The whole chest thus forms a cavity closed on all sides, but permitting the passage of certain tubes (the trachea, œsophagus, blood-vessels, &c.) through its walls. This cavity contains within it three subordinate cavities; the middle one contains the heart in the pericardium, and each of the two at the sides contains one of the lungs. These are called the pleural cavities.

Fig. 5.



1, the trachea; 2, the right lung; 3, the left lung: 4, fissures, dividing each lung into, 5, large portions termed lobes· 6, smaller divisions termed lobules; 7, pericardium; 8, heart; 9, aorta; 10, diaphragm separating the cavity of the thorax from that of the abdomen.

Each lung is as it were hung into the cavity appropriated to it by its bronchus and by the trunks of its pulmonary artery and veins, which, enclosed together by cellular tissue, form what is called the root of the lung. The lung exactly fills the cavity in which it is placed, so that their surfaces are everywhere in contact, or separated only by the very small quantity of fluid necessary to keep them sufficiently slippery to move upon each other without difficulty. For the sake of more easy motion, the wall of the cavity is lined and the surface of the lung is covered by a fine smooth membrane, the pleura, which is arranged like other serous membranes [Membrane], that is, having lined the cavity, it is reflected upon the root of the lung, and then passes over its surface and those of its great divisions or lobes.

The pleural cavities are completely closed on all sides, so that no air can enter them, but the lung in each communicates with the external air by its bronchus, which leads to the trachea and larynx; and hence, when the chest is enlarged by the contraction of the diaphragm, the elevation of the ribs, &c., the air passes not into the cavity of the chest, but through the windpipe into the interior of the lung. It is as if one had a pair of bellows with the valve closed, and the tube of the nozzle opening, not as it usually does, into all the space enclosed by the boards and leather, but into a bladder contained within that space. In this case, when the handle of the bellows is raised so as to enlarge the cavity, the air will pass into the bladder, and distend it so as to keep it everywhere in contact with the interior of the cavity containing it.

The acts of breathing are—*inspiration*, by which air is drawn into the lungs, and *expiration*, by which it is again expelled from them. In inspiration the muscles that are attached to and form part of the walls of the chest contract, and by raising the ribs and sternum, and flattening the diaphragm, increase its capacity. The air within the lungs (which are never empty even after the deepest expiration) is thus for the instant rarefied; but by the proportionally increased pressure of the atmosphere upon the upper part of the larynx, a fresh quantity of air immediately passes into the air-tubes, and maintains the equilibrium of pressure between the air within and that without the lungs.

As soon as the action of the muscles of inspiration has ceased, expiration commences; the lungs, distended in inspiration, contract by their own elasticity, and expel a volume of air which, in ordinary circumstances, is equal to that which they had just previously received. As fast as they contract, they are followed by the walls of the chest, which collapse partly by their elasticity, and partly by the pressure of the atmosphere upon their exterior, which, when the lungs begin to contract, is no longer exactly balanced by the pressure exerted through the medium of the lungs upon their interior. The lungs having thus contracted to a certain extent, the parts are restored to the same condition as before inspiration, and in ordinary circumstances that action is soon again commenced.

The enlargement of the cavity of the chest in common inspiration is thus effected: the diaphragm (*fig.* 3, 5) contracts; its muscular fibres, which are attached on the one hand to the interior of the lower ribs, the tip of the sternum, and the front of the spine, and on the other around a tendon (4, *fig.* 3) in its middle, shorten, and thus (as the first set of attachments are fixed) they draw down the middle of the muscle, lessen its convexity towards the chest, make it flatter, and press its under surface upon the contents of the abdomen, so that the abdominal walls become more prominent At the same time, or just previously, the intercostal muscles contract; the two upper ribs, being quite or nearly fixed at one end to the spine, and at the other to the upper part of the sternum (*fig.* 2), serve as fixed points towards which the upper intercostal muscles contracting draw the second ribs; these being thus fixed, the second pair of muscles contract, and draw up the third ribs; and so on through the whole of the ribs, the lowest serving, at the same time that they are drawn upwards, for fixed points, towards which the diaphragm, contracting all round its tendon, may draw down its middle part and become flatter.

The effect of the contraction of the intercostal muscles is not so much to approximate the ribs (which would decrease the capacity of the chest) as to force them further outwards and forwards, and thus give the chest a greater width and depth at each part. In *figs.* 2 and 4, it is seen that the ribs descend obliquely outwards and forwards from the spine, and then ascend towards the sternum. They increase in obliquity as they are taken from above downwards, and, except the four last, they also increase in length in the same succession. The length of the arc represented by each rib from the spine to the sternum is fixed, for the substance of the ribs is bony or cartilaginous, and almost unyielding; when therefore one rib is fixed, and the intercostal muscles between it and the one next below it contract, they must not only draw the latter upwards, but must also turn it somewhat outwards, and raise the sternum, which is fixed to its anterior extremity. The direction of the rib becomes less oblique, but its length remaining the same, the distance from the spine to the moveable sternum must be increased at the same time with the distance from each rib to the corresponding one on the opposite side.

By these actions the cavity of the chest is increased in every direction: in height, by the descent of the diaphragm; in width, by the turning outwards of the ribs; in depth, by the ascent of the sternum. In quiet inspiration the greater part is effected by the diaphragm; in deep inspiration not only are all the muscles already mentioned contracted, but a number of others capable of raising the ribs are called into play, and the capacity of the chest is thus yet further increased in the manner just described.

In their medium state the lungs of a person of ordinary size, and in good health, contain about twelve pints of air; in perfectly easy breathing, about a pint is drawn into them at each inspiration; but from this the quantity may vary to as much as seven pints, according to the force of inspiration, increased as it is, for example, when preparing for a great muscular effort, or during singing, or before coughing.

Quiet expiration does not need any muscular exertion; the elasticity of the lungs, of the cartilages of the ribs, and of the other parts distended in inspiration, is sufficient to restore them all to their previous state. A limit is set to the collapse of the lungs by the unyielding tissues of the walls of the chest. These cannot follow the contracting lungs beyond a certain extent, and the elasticity of the lungs is not sufficient for them to overcome the unbalanced pressure of the atmosphere upon their interior, which it would be necessary for them to do before they could contract from the interior of the walls of the chest. If a wound be made into either pleural cavity, the lung at once collapses completely, and expels nearly all the air it contained; for in this case the atmospheric pressure being admitted alike to the exterior and the interior of the lung, its elasticity has but little to overcome, and the air-cells and tubes immediately contract to the smallest size of which they are capable. By the same means, when both pleural cavities are opened at once, death speedily follows in consequence of the collapse of both lungs and the suspension of all breathing.

The limit which the rigidity of the walls of the chest sets to the elastic collapse of the lungs is never reached in ordinary respiration, nor in extraordinary cases, except by the influence of other expiratory powers besides those of the lungs. These powers are supplied chiefly by the muscles of the abdomen, which contract with great force, and through the medium of the contents of the abdomen force up the diaphragm to an unusual height into the chest, at the same time that certain muscles capable of depressing the ribs and sternum draw them down and decrease the capacity of the chest in its depth and width. Efforts of this kind are observable in coughing, sneezing, and all other strong expiratory acts.

Such are the movements of respiration These however are less important than the chemical changes effected in it, and are even not observed in certain classes of animals, in which the latter are nevertheless constantly carried on. The object of the movements of respiration is the constant renewal of the air in the bronchial tubes and cells. It has been already said that the lungs always (even after the most forcible expiration) contain some air. It is therefore not probable that that which is inspired passes at once to the air-cells, but rather that being drawn into the finer bronchial tubes, it mixes with the air already contained in them, and only gradually arrives at the cells. There is probably a kind of undulation of the volumes of air drawn in and again in part expelled at each complete act of respiration; and we cannot conceive how the air in the cells would be constantly renewed were it not for the tendency of the different kinds of gas to mix according to the laws of diffusion of gases discovered by Dalton, and so fully illustrated by Dr. Graham. The air in the cells contains a large quantity of carbonic acid; that drawn into the tubes in inspiration contains but little of that gas, but one-fifth of oxygen, and thus, independently of the movements of respiration, there must always be a tendency of the carbonic acid towards the atmosphere and of the oxygen towards the air-cells.

With respect to the actual changes in the blood, it was long doubtful whether that fluid contained any gases dissolved in it, and as many of the best chemists failed in their endeavours to extract any, it was commonly supposed that the carbonic acid produced by respiration resulted from the separation of carbon by the blood in the lungs and its immediate union with the oxygen of the air. But to this opinion was opposed the fact, that carbonic acid is given off from the lungs of frogs when they are placed in gases that contain no oxygen, as for example pure hydrogen or nitrogen. Many theories of respiration were therefore proposed, but all failed to explain its phenomena so long as gases could not be found in the blood. Of late years however it has been rendered highly probable, by the experiments of Stevens, Magnus, and others, that the blood does hold gases in solution, which may be separated from it by agitating it with another gas (according to the laws of mixture and displacement of gases dissolved in fluids), or by placing it in nearly an absolute vacuum. The theory of Despretz and Hassenfratz, which had been discarded, is therefore now generally received; and it is believed that the chemical changes of respiration consist essentially in the removal of a portion of the carbonic acid dissolved in the venous blood, and the absorption of an equal or rather larger portion of oxygen from the air; and that these changes are effected not by any vital act of secretion, but by the tendency to mixture of the different gases, which is not obstructed by the delicately porous tissues of the air-cells and the capillary vessels.

It appears from the experiments of Magnus (which are in great part confirmed by those of Stevens, Hoffmann, Gmelin, Bertuch, and Bischoff), that the mean quantity of gas contained in the blood is equal to $\frac{1}{10}$ of its whole volume. In venous blood the average quantity of carbonic acid is about $\frac{1}{18}$, that of oxygen about $\frac{1}{35}$, and that of nitrogen about $_{100}$ of the volume of the blood; in the arterial blood their respective quantities are $\frac{1}{14}$,* $\frac{1}{35}$, and $\frac{1}{12}$. (Müller's *Physiologie*, vol. i., ed. 2.) It follows therefore that the purpose of respiration is chiefly the absorption of oxygen, and not merely the removal of carbonic acid from the blood; a conclusion which is also rendered probable by the fact that frogs placed in hydrogen or nitrogen die as if suffocated, although as much carbonic acid is given off from their lungs as when they breathe in atmospheric air.

The constant process of respiration effects changes in the blood that are of the first importance to life and health. The watery vapour exhaled from the blood as it passes through the lungs more nearly in contact with the atmosphere than it is at any other part of the system, amounts, according to the experiments of Lavoisier and others, to nearly 8000 grains in 24 hours. The quantity of carbonic acid given off during the same time is estimated to be at the least 14,930 cubic inches, or 8534 grains, containing 2820 grains of carbon; and the quantity of oxygen absorbed amounts in different circumstances to from ⅕ to ⅓ more than that of the carbonic acid given out. Nitrogen appears to be in some circumstances exhaled, and in others absorbed; but on this point the results of experiments are at present far from conclusive.

Dr. Prout has shown that the quantity of carbonic acid separated from the blood varies at different periods of the day; it is greatest between 11 A.M. and 1 P.M., and least between ½ past 8 P.M. and ½ past 3 A.M. Its quantity is also diminished by anxiety and other depressing passions, by exercise, by strong drinks, or vegetable food; but it is increased when the barometer is low.

The suspension of respiration by any causes produces asphyxia, or suffocation. The oxygen of the blood is essential to the maintenance of the life of the parts in which it circulates, and an excess of carbonic acid in it acts as a poison. It has been already stated that animals die in hydrogen though the carbonic acid is given off; these perish for want of oxygen. Others are destroyed by the excess of carbonic acid; as those who die after breathing the same atmospheric air for some time, but before all its oxygen is consumed, and those who die in an atmosphere containing an abundance of oxygen, but at the same time charged with a large portion of carbonic acid. The phenomena of asphyxia, and the peculiar conditions on which it depends, are considered in a separate article. [ASPHYXIA.]

RESPIRATOR, or breath-warmer, an instrument recently invented and brought into use by Mr. Julius Jeffreys, for giving warmth to the air drawn into the lungs in breathing, and thereby enabling invalids to enjoy the benefits of exercise in the open air without injury or inconvenience.

The common practice of wrapping up the lower part of the face in a woollen covering warms the air inhaled through it very imperfectly, and in an unwholesome manner, by mixing with it a portion of the impure air exhaled from the lungs, and detained in its bulky folds. A woollen wrapper, being a non-conductor of heat, can act in no other way. In the respirator this disadvantage is avoided by causing the air discharged from the lungs to pass through several layers of very fine wire, fixed so near together that the breath passing through them is almost infinitely divided, its warmth being abstracted by the metal, which, being an excellent conductor of heat, freely imparts it to the fresh cold air drawn, or, as it were, filtered through it. The compactness of the instrument is such that there is no room for the lodgment of the impure air expelled from the lungs, and consequent contamination of that inhaled; and the condensation of moisture on the wires corrects the injurious dryness of the atmosphere in some northerly winds.

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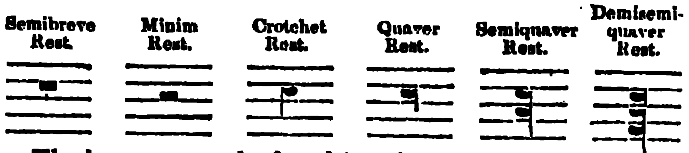
* The fact that in Magnus's experiments the arterial blood was found to contain more carbonic acid than the venous, shows that though they may be sufficient to establish this explanation of respiration, all the details of the process still require to be more carefully examined.

The means by which these objects are attained in the respirator display much ingenuity in contrivance, and no ordinary degree of skill in the execution. The inventor considers it necessary that about twenty layers of metal-work should be used, and, in order to make the instrument as light and compact as possible, each layer is required to be exceedingly thin. The apparatus usually consists of from eight to twelve frames of sheet-silver or other metal, about three inches and a half long, one inch and a half wide, and $\frac{1}{200}$th part of an inch thick; the metal of which is pierced away by machinery so as to leave merely a narrow frame containing six vertical bars of $\frac{1}{30}$th and five horizontal bars $\frac{1}{90}$th of an inch wide. On both sides of each of these frames a layer of wires an inch and a half long and $\frac{1}{450}$th of an inch thick is soldered, care being taken to connect each wire, not only with the top and bottom bars of the frame, but also with each of the five horizontal bars. The wires are laid about $\frac{1}{200}$th part of an inch apart, and are so numerous that a large respirator of high power contains 2000 feet of wire, divided into about 12,000 pieces, and soldered to the frames at more than 80,000 distinct points. The frames or lattices of wire-work, are fixed parallel to each other, and kept a short distance apart by small studs of a substance which is a slow conductor of heat, so that the inner layer is always kept, as nearly as possible, at the temperature of the air expelled from the lungs, and each successive layer diminishes in warmth, till the outer one is nearly as cold as the external air. The curious and philosophical application of a non-conducting medium between the metallic screens is essential to the perfect action of the instrument, as without it the heat would be equally diffused, and no part of the metal-work could retain more than half the temperature of the breath. By this arrangement the air inhaled, finding each layer of wire warmer than the preceding, is gradually raised, in respirators of the highest power, to the greatest attainable temperature. The most powerful respirators have twenty-four layers of wire-work, those of medium power sixteen, and the lowest power eight. The whole of the wire-work is bent into a curved form, and enclosed in a bordering or case of soft leather, which is made to fit closely to the face of the wearer, so as to prevent the entrance of air otherwise than through the metal-work, and to hold the latter in such a position that the lips do not come in contact with the wires. An outer covering of silk or other material is added, having an aperture in which is inserted a very thin plate of silver, perforated with minute holes, and to which a dark colour is imparted by a chemical operation, to serve as a screen to the wire-work, which it hides without impeding the passage of air as most textile fabrics would do. Recently however a very fine and open woollen fabric has been made use of in lieu of the perforated plate, to suit the wishes of some persons to whom the appearance of the instrument was an objection. The common or *oral* respirator covers the mouth only; but a variety called the *orinasal* respirator encloses the nostrils also. A piece of sponge attached to the lower edge of the instrument collects the moisture condensed from the breath, and it, as well as the metal-work and leather mounting, may be detached from the outer covering and cleaned when necessary.

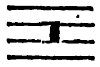
Owing to the complicated and delicate construction of the respirator, for the manufacture of which novel machinery has been required, its price has necessarily been rather high; but some have been lately made of inferior materials at a price within the reach of the poorer classes, in the hope that a very large demand may meet the cost of production. Notwithstanding its recent introduction (the patent having been obtained in 1836), it is already extensively used, and has enabled many who were unable to bear exposure to the severity of an English winter, to face the severest weather with impunity, and even with benefit to their general health; its efficiency having led some patients to designate it a 'portable warm climate.' The orinasal respirator is chiefly used for sleeping in, as it frequently affords relief from distressing night coughs arising from irritation of the air-passages, and enables patients to enjoy undisturbed rest. In addition to the comfort afforded by it, the respirator is expected to prove a preventive of diseases of the lungs; and it has been found beneficial by some for indoor use, because, by economising the animal heat, it promotes a genial warmth in the limbs. It should be stated that the respirator occasions no obstruction to the voice.

RESPONDE'NTIA. [BOTTOMRY.]

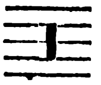
REST, in music, a character denoting silence; a cessation of sound equal in duration to the note represented by the *rest*. As there are six musical characters called notes, so there are as many rests. Ex.:—



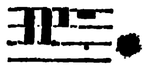
The breve rest, to be found in old music, is a short thick bar connecting two lines. Ex.:—



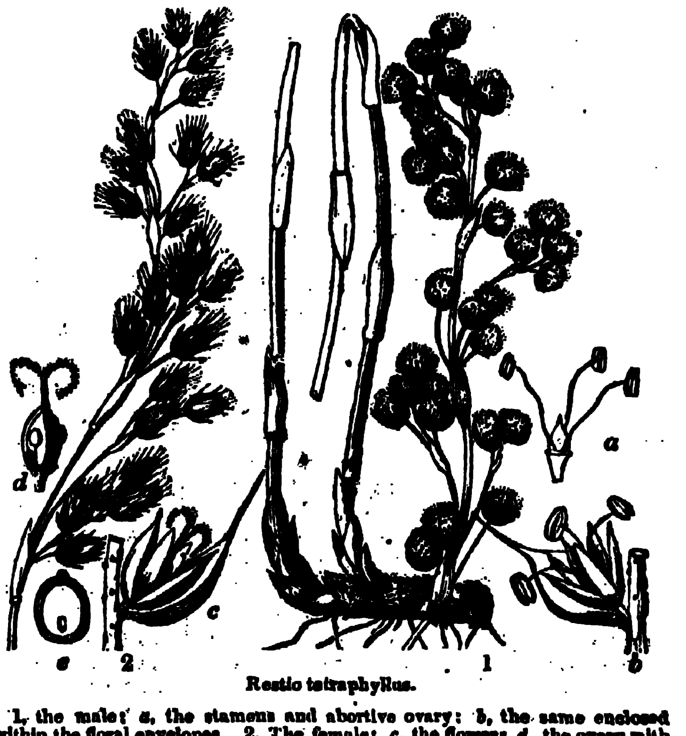
In separate vocal and instrumental parts, a character uniting three lines, and indicating a rest four bars in duration, is employed. Ex.:—



The following is the manner of directing a silence, or rest, of eleven bars, in any of the modern times or measures:—



RESTIA'CEÆ, a natural order of plants, principally inhabiting the southern hemisphere, and nearly related to the Cyperaceous order of Europe. They abound at the Cape of Good Hope and in New Holland, where they form a hard, wiry, rushlike herbage. They have in general a scaly, creeping, rhizoma, or root-stock, simple stems clothed with the sheaths of abortive leaves, and glumaceous flowers with a tolerably regular structure. The floral envelopes generally consist of 4 or 6 glumes in two rows. The stamens are two or three; the ovary for the most part 2-3-celled, with a single ovule in each cell. The fruit is either a nut or a



Restio tetraphyllus.

1, the male; *a*, the stamens and abortive ovary; *b*, the same enclosed within the floral envelopes. 2, The female; *c*, the flower; *d*, the ovary with abortive stamens; *e*, a section of the ripe seed, showing the embryo.

3-celled seed-vessel; the seeds are pendulous, and the embryo is a small lenticular body lying within albumen at the end of the seed most remote from the hilum. In almost all cases the sexes are separate. The hard texture of some species renders them suited for thatch for houses, but they are of no other use.

RESTITUTION (in Law) *of lands*. Where a forcible entry or detainer of lands is on inquiry duly found, or after conviction under an indictment for a forcible entry, the court before whom the inquiry is made, shall cause *restitution* of the lands to be made to the party who has been turned out of possession. (Com., *Dig.*, 'Forceable Entry,' D 5, &c.)

Restitution of stolen goods. By 7 and 8 G. IV., c. 29, s. 57, if any person guilty of a felony or misdemeanor under that act, in stealing, converting, or receiving any property, shall be indicted for such offence by the owner or his executor, and convicted, the property shall be restored to the owner, and the court before whom the person shall be convicted shall have power to award writs of restitution for the property, or order it to be restored in a summary manner. Provided that if it shall appear that any valuable security shall have been *bonâ fide* paid or discharged by some person liable to pay it, or being a negotiable instrument shall have been *bonâ fide* taken or received by transfer or delivery by some person for a valuable consideration, without any reasonable ground to suspect that it had been stolen, &c., then the court shall not order the restitution of such security.

Before this act, the owner was in all cases entitled to restitution on conviction for a felony, but not for a misdemeanor. During the period between the theft and the conviction, or acquittal or death of the prisoner, the ownership of the property is suspended. (2 *Inst.*, 711; Horwood v. Smith, 2 *T. R.*, 750; Burn's *Justice*, 'Restitution.')

Restitution also formerly took place where the heir of one attainted of treason was relieved from the consequences of the attainder. (3 *Inst.* 'Restitution.')

RESTORATIONS, in Architecture, a term applied to drawings intended to show antient buildings according to their original design, [illegible] made out from their existing remains, aided by such descriptions or hints as are to be obtained from classic authors, or from the representations of them on coins. In some cases the building itself will afford sufficient data for a complete restoration of it upon paper; but in others, considerable research and study are requisite, and, after all, the restoration will be chiefly conjectural. Even the best preserved architectural monuments of antiquity are in fact only comparatively entire, and are more familiar to the student in their restored than in their actual form; for many of them present only masses of ruins, which it would be a work of time and study to investigate without the assistance of the drawings of those who have already done so. For our knowledge of some edifices we are now entirely indebted to the labours of those who had made drawings of them both in their actual state and in what they have supposed to be their original one, even the remains of them having disappeared since their time. Restorations are frequently also very necessary in order to give an accurate idea of buildings which, although still entire, have been greatly altered and disfigured by having been adapted to other uses—by modern additions or spoliations. Such is the case with the Pantheon at Rome, which now presents little more than the mere carcass of the antient structure, having been stripped of all its bronze work and sculpture, and modernised in its interior with much that is in a very inferior taste, to say nothing of the two belfries that form such barbarous excrescences to the exterior. [PANTHEON.] This edifice has accordingly been frequently made the subject of *restorations*. Zahn and others have made some interesting restorations of private mansions at Pompeii, for which there exist tolerably sufficient if not complete data, both as regards the buildings themselves and their interior decorations, besides various articles of their furniture. But there are many things in regard to which it is now hopeless to look for satisfactory evidence in any remains of antient structures; and among them is the *scena* or stage of a Greek or Roman theatre, relative to which very little that can be safely depended upon is now known: nothing more in fact than a few of the permanent decorations, which of course do not go far towards elucidating the entire arrangement and construction of that part of such edifices; consequently we are quite at a loss to understand what was their stage apparatus, and what were the contrivances resorted to for the machinery which was occasionally requisite. Besides the changes which buildings themselves have undergone, either through decay or from accidental causes, there are others which are hardly considered as belonging to the province of architectural restorations, namely, those of *locality*, by which term we understand not the mere situation, but all the surrounding objects—the entire scene or view, of which the edifice now remaining was the principal feature. Thus, though we can form a tolerably exact idea of the Parthenon, and also of the other buildings on the Acropolis, and are at no loss as to their relative situation, all the rest is a mere blank, which we are now wholly unable to fill up so as to complete the entire scene with all its details, and which therefore may be compared to a picture from which all but the heads of the figures have been effaced.

RESULTING USE. [USE.]

RESUSCITATION (from *resuscito*, to arouse, to revive), the restoring to animation of persons apparently dead. Under this term, strictly speaking, should be considered the restoration of all cases of suspended animation, whether arising from disease or as a result of asphyxia; yet it is chiefly made use of to designate the recovery of persons from this latter condition. The symptoms, physiological conditions, and causes of asphyxia are fully described under that head; the treatment of it generally, and of its different varieties, was reserved for the present article. Although the suspension of all the vital actions of the system which takes place in asphyxia has originated from the temporary interruption of a single function, yet the derangement which has followed is of so complicated a nature, and extends to so great a number of important organs, that the mere re-establishment of the function primarily disturbed is not immediately followed by the restoration of the rest, and by the removal of all the mischief. The mere introduction of fresh air into the lungs cannot at once restore the action of the heart, or of the diaphragm, and of the other muscles which are concerned in respiration, because these muscles have lost either the whole or the greater part of their irritability, in consequence of having been supplied with venous instead of arterial blood. While the first and principal object is to bring the blood contained in the pulmonary vessels under the influence of atmospheric air, attention must at the same time be paid to the state of the circulation, and to the restoration of those powers by which that function, as well as respiration, is to be carried on. The first of these objects can be accomplished by the artificial inflation of the lungs; the second is to be attempted by the judicious application of stimulants to various parts of the body. The details of these processes have been already given in the article DROWNING. But asphyxia may also occur from the presence of foreign bodies in the larynx, which mechanically prevent the inflation of the lungs through the natural passage; in this case the operation of tracheotomy must be resorted to, and the pipe of the bellows must be introduced into the windpipe through the opening thus artificially made. In addition to the employment of artificial respiration, and the use of external and internal stimulants, many physicians have recommended blood-letting; but besides the doubtful advantage which sometimes may accrue from this practice, it is not always possible, and such is especially the case if the asphyxia is of long continuance. In general, the effects of blood-letting would be injurious, and it is now rarely had recourse to unless there are very unequivocal indications of great pressure on the brain. Whatever may be the means that we employ, they should be persevered in till the signs of death are no longer equivocal. Dr. Currie, in his 'Observations on Apparent Death,' recommends their being persisted in for at least six hours; the French writers mention the commencement of rigidity of the limbs as the only criterion of the hopelessness of continuing our efforts. The first signs of returning animation are slight convulsive twitchings in the muscles of respiration, which give rise to gaspings and sighings. By degrees these spontaneous efforts become more regular, and natural respiration is restored; and together with it the circulation returns. The first return to sensation is usually attended with great suffering, and the utmost attention is required to guard against the dangerous symptoms which sometimes show themselves at this period; in illustration of which we may quote the following case, mentioned by Dr. Paris:—A corporal of the Guards was seized with cramp as he was bathing in the Thames, and remained for several minutes under water. By judicious assistance however he was recovered, and appeared to those about him to be free from any danger, when he was attacked with convulsions, and expired. Had the respiration been artificially supported at this period, so as to have maintained the action of the heart until the black blood had returned from the brain, it is probable that the life of the soldier might have been preserved.

Treatment of particular kinds of Asphyxia.—This is to be conducted upon the general principles before explained, which must be varied only according to the particular condition of the body at the time. If the temperature is much below the natural standard, as after immersion in water, the application of heat must by no means be neglected. On the contrary, should the temperature of the body be at or above its natural standard, no more powerful excitant can be used than cold water; hence the dogs which are made the subject of experiment at the Grotto del Cane are usually plunged into a neighbouring lake after exposure to the mephitic gas, as a means of hastening their recovery. It is in the treatment of persons apparently dead from hanging, or other modes of strangulation, that a small quantity of blood drawn from the jugular vein is useful in unloading the vessels of the brain; but the depletion must be merely sufficient to effect this object, and must not be carried to the extent of weakening the powers of life.

RETAINER. [EXECUTOR; SERJEANT-AT-LAW.]

RETARDATION. [ACCELERATION.]

RETE'PORA. [POLYPIARIA.]

RETFORD, EAST, a borough in the North Clay division of the wapentake or hundred of Bassetlaw, in the county of Nottingham, in England, 128 miles in a direct line north-north-west of the General Post-Office, London, or 142½ miles by the Edinburgh and York mail-road through Ware, Huntingdon, Stamford, Grantham, and Newark; in 53° 19′ N. lat. and 0° 56′ W. long.

East Retford stands on the right or east bank of the river Idle, a feeder of the Trent. The area of the borough and parish (for the two are coincident) comprehends only 130 acres (the greater part of which is built over), but the town extends into the adjacent parishes of Clareborough and Ordsall: and the village of West Retford, which is on the opposite side of the river, and is connected with East Retford by a bridge, may be regarded as a portion of it. The borough had, in 1831, 507 houses, inhabited by 525 families; 38 houses uninhabited, and 1 building: the population was 2491, scarcely any part of it agricultural: Clareborough (one of the parishes forming the liberty of Southwell and Scrooby) had an area of 3870 acres; 477 houses, inhabited by 501 families, 28 houses uninhabited, and 2 building, with a population of 2106, about one-fourth agricultural: Ordsall (in the Hatfield division of Bassetlaw wapentake) had an area of 1930 acres; 186 houses, inhabited by 190 families, 14 uninhabited, and 5 building, with a population of 809, about two-thirds agricultural: and West Retford (in the same division) an area of 1080 acres; 150 houses, inhabited by 152 families; and 2 houses uninhabited, with a population of 593, about one-fifth agricultural: making a total of 7110 acres; 1320 houses, inhabited by 1368 families; and a gross population of 5999.

The town thus composed consists of several streets, the principal of them converging not far from the head of the bridge on the East Retford side. The streets (in the borough at least) are well paved, and lighted with gas. The houses both in East and West Retford are very good. The chief extension of the town of late years has been on the south side of the borough, in the suburb of South Retford, in Ordsall parish. The church of East Retford, dedicated to St. Swithin, is large and handsome, with a lofty square tower: it is of various dates, and exhibits the different styles of Gothic architecture. It was antiently larger, but portions of it have been pulled down. West Retford Church is small, with a tower and an elegant crocketed spire. Clareborough and Ordsall churches are both remote from the town; but in the suburb of Moorgate, in Clareborough parish, a chapel-of-ease has been built in the later Gothic style. There are several dissenting places of worship. The town-hall is a neat and commodious building: there are a theatre, a news-room, a free-school, and one or two ranges of almshouses. There is scarcely any kind of manufacture carried on, the business of the town being a retail trade for the supply of the surrounding agricultural district. Formerly there was a good deal of malting; afterwards the manufacture of hats was introduced; and the late Major Cartwright established a worsted-mill, which gave employment at one time to 600 people, but ultimately failed. The market is on Saturday, and is in autumn well supplied with hops, of which many are grown hereabout: there are two yearly fairs; and one great market for horses, black cattle, cheese, and hops. The river Idle is not navigable at this part of its course; but the Chesterfield Canal passes close to the town, and opens a communication with the Trent.

The borough is said to be a borough by prescription: various charters have been granted by Henry III. and succeeding sovereigns. At the time of the Report on Municipal Corporations, petty-sessions weekly and quarter-sessions for the borough were held. The Court of Record had fallen into disuse. The corporation, under the Municipal Reform Act, consists of 4 aldermen and 12 councillors, and the town is not to have a commission of the peace, except on petition and grant.

This borough sent members to parliament, 9 Edward II.; but for a long time after that period, its right was suspended or disused. In 13 Elizabeth it returned members again, and has done so ever since; but in consequence of a parliamentary inquiry into the corruption practised at the election in 1826, the suffrage was extended to the freeholders of the hundred of Bassetlaw. The number of voters on the register in 1834-5 was 2459; in 1835-6, 2835.

The living of East Retford is a vicarage, of the clear yearly value of 140*l.*, with a glebe-house; that of West Retford is a rectory, of the clear yearly value of 364*l.*, with a glebe-house.

There were in the borough, in 1833, eleven day-schools (one of them an endowed grammar-school), with 293 scholars; and two Sunday-schools, with 377 children. The three parishes of West Retford, Clareborough, and Ordsall contained one boarding-school, with from 12 to 14 scholars; twelve day-schools, with 240 or 250 scholars; and six Sunday-schools, with about 609 children. The grammar-school, though wealthy, was comparatively inefficient, through abuse and consequent litigation.

RETHEL, a town in France, capital of an arrondissement in the department of Ardennes, on the north or right bank of the Aisne, 117 miles from Paris by the road through Soissons and Reims, and 27 miles from Mézières, the capital of the department.

This town is supposed to have been built on the site of a Roman fort. In the middle ages it was under its own counts, and was made, in 1581, the seat of a duchy conferred by Henri III. on Charles de Gonzague, duke of Nevers, whose descendants sold it to Cardinal Mazarin. It was taken by the Spaniards, A.D. 1650 and 1655; the second time it was retaken by Turenne. Its territory was called Le Rethelais. The town stands on a hill sloping down to the river, over which there is a wooden bridge communicating with the suburb of Les Minimes, on the opposite bank of the river. There are three other suburbs; and the town is entered by three old gates. The streets are tolerably wide and well laid out, but steep; the houses, usually of two stories above the ground, are of wood, and rather meanly built. There are two large squares or places; one of them, the market-place, is large, and has a good market-house. There are two parish churches, and two other churches or chapels. The church of St. Nicholas has a tolerably handsome steeple.

The population of the commune, in 1826, was 6147; in 1831, 6585; and in 1836, 6771. It is a busy little place; woollen yarn is spun, and as water is employed as the moving-power, two small streams which flow into the Aisne are turned to good account in this way: cachemires, woollen cloths, kerseymeres, flannels, merinos, and other woollens are woven. There are tan-yards and curriers' shops, breweries, and iron-forges. Considerable trade is carried on by means of the canal of Ardennes, which opens or will open a communication between the Meuse and the Aisne. The neighbourhood of the town is fertile, yielding timber and pasturage, and containing stone-quarries and iron-mines. There are six fairs in the year.

Rethel has a high school, an agricultural society, an hospital, an asylum for old people and foundlings, two prisons, and a theatre. There is an agreeable promenade on the banks of the river planted with elms.

The arrondissement of Rethel contains 124 communes it is divided into six cantons or districts, each under a justice of the peace: the population, in 1831, was 65,845.

RETI'CULUS, or RETICULUM RHOMBOIDA'LE (the rhomboidal network formerly used to divide the field of a telescope), a southern constellation of Lacaille, situated directly between the great stars of Argo and Eridanus.

Character.	No. in Catalogue of		Magnitude.
	Lacaille.	Astron. Society.	
β	292	425	4
δ	313	450	5
γ	317	465	5
α	329	485	3
ε	331	489	5
θ	336	500	6
η	340	514	5

RETI'FERA, M. de Blainville's first family of his order *Cervicobranchiata*. [CERVICOBRANCHIATA.]

RE'TINA. [EYE.]

RETINASPHALTUM occurs in irregular opaque masses of a pale brownish-yellow colour, having a glistening lustre and imperfect conchoidal fracture. It is soft and brittle, melts when placed on hot iron, smokes, and afterwards burns with a bright flame, emitting a fragrant odour. Partly soluble in alcohol, leaving an unctuous residue. It is more nearly allied to bitumen than any other substance. Specific gravity 1·1 to 1·2.

That found near Bovey Tracey in Devonshire has a dry earthy texture; that from Wolchow in Moravia is hard and resinous. According to Hatchett, it contains—

Resin soluble in alcohol . .	55
Insoluble bituminous matter .	41
Earthy matter	4
	100

RETORT, a chemical vessel in which distillation or decomposition is effected by the application of heat; for different purposes retorts are made of glass, earthenware, and metal.

Glass retorts are usually of the annexed form, with a receiver attached; they may be employed for the preparation of such products as do not require any extraordinary degree of cold for the condensation of their vapour: such a liquid is nitric acid. In this cut *a* represents the body of the retort, *b* the neck, and *c* is the receiver, secured to the retort by means of lute. To prepare this acid, nitrate of potash is carefully conveyed by the neck into the body of the retort, and then sulphuric acid is added to it by means of the retort funnel *d*, which prevents any of this acid from remaining in the neck of the retort, and being washed down by and contaminating the nitric acid, as it condenses and passes into the receiver. In this case, when heat is applied to the retort, nitric acid and water rise together in vapour from the body of the retort, and are condensed in the neck; but when the product is more difficult of condensation, the neck of the retort is lengthened by placing an adapter *e* between it and the receiver, to both of which it is secured by lute; it being understood that the wider end slips over the aperture of the retort, and the narrower one is admitted into the mouth of the receiver. In some cases condensation is accelerated by causing a small continuous stream of water to fall on the neck of the retort.

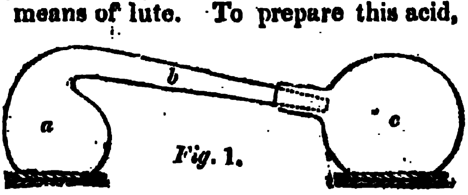


Fig. 1.

Fig. 2.

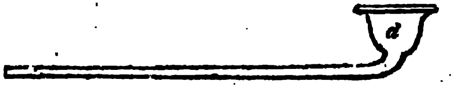


Fig. 3.

A stoppered retort *f* is sometimes used instead of a plain one; these retorts are more expensive, but much more convenient than common ones; for both the dry and the liquid substances to be employed in the operation are passed into the body of the retort through the aperture, which is afterwards secured by a stopper, without having recourse to the retort funnel. Frequently also a quilled or tubulated receiver is used instead of the plain one above described: this is represented by *g*; the tube is inserted into a bottle *h*, and this, when ammonia or other very volatile or difficultly condensible products are distilled, dips into water, or the receiving-bottle itself is immersed in water kept cold by ice or by a freezing mixture, as when hydrocyanic acid is distilled:—*i* is the stand which supports the retort, and *k* is the lamp by which heat is applied to it.

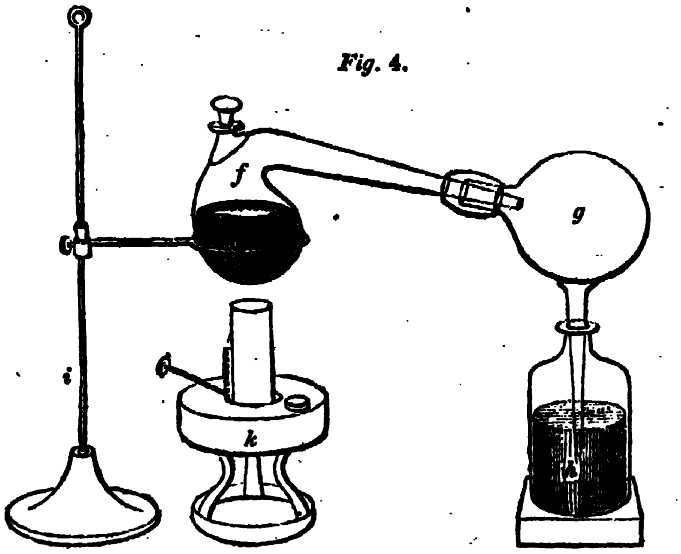


Fig. 4.

Glass retorts and receivers are made of various sizes, capable of containing from a few ounces to several gallons, and both flint and green glass are used in their manufacture. Usually, instead of applying heat by a lamp, retorts are heated in a sand-bath, and sometimes they are subjected to the direct action of the fire; but before this they are very commonly protected by a coating of lute. [LUTE.]

In general, when the application of the higher temperatures is required for distillation or decomposition, earthen retorts are employed. In preparing hydrofluoric acid, lead is used; and in concentrating sulphuric acid, platina retorts are now largely employed, and would be universally so, were it not for their very high price.

In the destructive distillation of coal [GAS LIGHTING] iron retorts are used, and also, on the small scale, for obtaining oxygen from the peroxide of manganese, and various other chemical operations.

RETRENCHMENT, in Fortification, is a work constructed within another, in order to prolong the defence of the latter by impeding or preventing the formation of lodgments when the enemy has gained possession of it; or to afford protection to the defenders till they can retreat with safety or obtain a capitulation. In the latter respects the interior work is called by the French engineers a *reduit*.

Every principal work in permanent fortification is provided with its retrenchment or reduit; and some of these, as the reduit of the ravelin, and of the re-entering places of arms, are constructed at the same time as the work itself, while others, as the retrenchments within a bastion, are generally executed but a short time before they are wanted.

In 1552, when Metz was besieged by Charles V., the Duke of Guise, who commanded in the town, by constructing new ramparts within the old, as fast as the latter were destroyed by the besiegers, succeeded at length in compelling the emperor to raise the siege; and at the siege of Candia (1666-1669), the Venetians raised a rampart from one curtain to the next in rear of the gorge of the bastion St. Andrea, so that, long after that bastion was breached and taken, the town continued to hold out. Such prolonged defences are now rare, and the governor of a fortress is considered as having fulfilled his duty if he do not surrender till a breach has been made in the rampart of the enceinte; though if the bastion were retrenched, he might sustain an assault without any risk of being refused a capitulation, or of seeing the town given up to be plundered.

In the event of the assailants gaining the top of the breach, the defendants would be able to retreat within the retrenchment, the fire from which might then be concentrated upon the enemy while confined within the comparatively narrow space between the faces of the bastion.

The kind of retrenchment proposed by Cormontaigne for the bastion of a fortress is a rampart or parapet extending across the interior of the work in a right line, or rather in the form of a tenaille. [X, FORTIFICATION, vol. x., p. 377.] Its extremities join the faces of the bastion at 20 or 30 yards in front of the shoulders, by which means the flank is left quite free, so that all its artillery can be employed in the defence of the main ditch, and there is room between the retrenchment and the shoulder of the bastion for two guns, by which the interior of the ravelin and the ditch of its reduit might be defended, if necessary, even after the enemy had made a lodgment in the bastion.

As the retrenchment in this situation is liable to be enfiladed by a battery of the besiegers on the glacis before the collateral bastion, it is proposed that another should be formed in rear of the gorge of the bastion attacked; and as in this case there would be sufficient room, the retrenchment may be in the form of a front of fortification with a revetted scarp and counterscarp.

The ditch in front of a retrenchment, as at X [FORTIFICATION], is cut quite through the parapet of the bastion, in order to prevent the enemy, after the assault at the breach, from passing along the top of that parapet, and getting to the rear of the retrenchment. This opening of the parapet does not however go lower than the level of the cordon of the scarp revetment, in order to avoid diminishing the height of that scarp, and thus offering a facility to the enemy, should he attempt to escalade the work at that place.

Cormontaigne proposed to retrench small bastions by constructing within them cavaliers of the same form as the bastion itself, and having a command of 5 or 6 feet above it. The fire from this high parapet might give the work some advantages during the progress of the siege; but from its figure a cavalier appears to be less proper than a retrenchment in the form of a tenaille, for the defense of the terreplein at the top of the breach.

It is evident that full bastions like A [FORTIFICATION] must be more convenient for being retrenched than those which are of the kind called hollow, as B; since less earth is wanted to raise the retrenchment to the required level, and the scarps are covered by the opposite side of the ditch from the view of the enemy at the top of the breach. The most simple manner of retrenching a hollow bastion would be that of retaining the rampart on the interior side, where it is usually 10 or 12 feet high, by a wall, and cutting a deep ditch at the foot; then forming a traverse across the terreplein of the rampart on each face (at 20 or 30 yards from the salient angle of the bastion) with a ditch in front. The enemy, in gaining the top of the breach, would then find himself arrested by these obstacles, and exposed to the fire of the defenders, till ladders and the support of a large body of troops could be obtained. The bastions of Ciudad Rodrigo, Badajos, and St. Sebastian were retrenched in this manner when those fortresses were besieged by the British and their allies during the Peninsular war.

Vauban, having observed that the ravelin was sometimes abandoned by the defenders previously to an expected assault, on account of the difficulty of retreating across the main ditch under a fire from batteries on the glacis before the bastions, constructed, in the interior of that work, another, which might afford the defenders protection till the coming night would permit them to retire in safety. This work was at first only a wall, pierced with loop-holes for musketry and covering the steps at the gorge; but when Vauban increased the size of the ravelin, he made this reduit, or retrenchment, to consist of a rampart and parapet similar to those of the ravelin itself, as at Nouf Brisac; and Cormontaigne subsequently enlarged the work, so as to render it a second ravelin, as at Y [FORTIFICATION]. This spacious retrenchment contributes much to the prolongation of the defence of the ravelin, since it is capable of containing a large body of troops; and each of its flanks can carry three guns, whose fire might be directed against the counter-battery at the salient of the bastion, or might serve for the defence of the breach in the face of the latter, should the enemy attempt to make an assault before he has obtained possession of the reduit. But to take this last, it would be necessary to breach its faces either by artillery or by mining; and the passage of its ditches would be difficult under a close fire from the ramparts near the shoulders of the neighbouring bastions.

In order that the defenders might be able to retain possession of the extremities of the ravelin, near the main ditch, after the salient part may have been taken, retrenchments, or coupures, as they are called, similar to the traverses, *t*, *t*, &c., are recommended to be formed across the terreplein of the ravelin. Behind these some of the defenders may retire, and keep up a fire against the enemy's lodgment near Z.

When Vauban had enlarged the re-entering places of arms, L [BASTION; FORTIFICATION], he retrenched the interior with stockades, which, by covering the steps leading from the ditches in their rear, protected the retreat of the defenders of the covered-way; and Coehorn appears, about the same time, to have constructed brick walls, provided with loop-holes, in the places of arms, at Bergen-op-Zoom, for the same purpose. But Cormontaigne, in order to render the defence of the places of arms more obstinate, and to secure more effectually the retreat of the defenders of the covered-way, constructed reduits, as W [FORTIFICATION], with parapets of earth 12 or 14 feet thick; and he revetted the sides of their ditches, in order to diminish the risk of a surprise: he also gave them flanks, which he made perpendicular to the covered-way, that a fire of light artillery or musketry might be directed from them against the enemy while attempting to crown the salients of the ravelin. These reduits moreover cover the shoulders of the bastions and the portions of the curtain which might be seen and breached by a fire directed between the flanks of the bastions and the tenailles; and their faces are directed so that they cannot be enfiladed. The crest of their parapet is about four feet higher than that of the glacis in their front.

The advanced works about a fortress are recommended to be retrenched with round-towers of masonry, provided with upper and lower tiers of loop-holes for musketry. These are called *safety redoubts;* and in Montalembert's 'Fortification Perpendiculaire,' such towers are constructed, to carry artillery, within the rampart of the enceinte.

For retrenchments in field fortification, see BLOCKHOUSE.

RETROGRADE, moving backwards, as opposed to DIRECT. In astronomy all motion from east to west is retrograde: thus the apparent motion of the heavens is retrograde, and the earth's diurnal motion, which causes it, is direct.

RETURN OF CATTLE, &c. is a term applied to the restoration of cattle, &c. distrained, to the party by whom they were distrained, after it has been ascertained that the distress was rightfully taken. The restoration of the cattle, &c. distrained to the owner is not called a return, but a replevin. [REPLEVIN.]

RETURN OF WRITS. When process [PROCESS] issues, the party to whom it is directed is commonly required to do a specified act, to certify the court in what manner the command has been executed, and at the same time to produce or *return* the process itself. Hence the whole answer to the process is called the return. In most cases, this is a duty performed by the sheriff. [SHERIFF.]

RETZ. [LOIRE INFERIEURE.]

RETZ (JEAN FRANÇOIS PAUL DE GONDI), CARDINAL DE, descended of a rich and powerful house, was born in October, 1614. Destined by his father to the church, in the hope of his obtaining the archbishopric of Paris, then held in succession by two members of his family, he was compelled to enter upon a profession repugnant and unsuitable to his ardent, unscrupulous, and intriguing temper. His youth was sullied by debauchery, while at the same time his theological studies were prosecuted with success and distinction; but in the history of the contests of parties in Greece and Rome, he found a more congenial pursuit, and brilliant and seductive examples of what he most coveted, political ability and success. His first political connection was with the Comte de Soissons, to the success of whose revolt he looked forward for the means of abandoning his profession. Disappointed by the death of that nobleman, he resumed with more regularity his ecclesiastical studies and employments; and gained the good opinion not only of the clergy of Paris, but of Louis XIII., who, on his death-bed (1643), named Gondi coadjutor to his uncle the archbishop of Paris. He devoted himself zealously to discharge the external functions of his office; and by this regularity, and by his profuse distribution of alms, established his popularity with the citizens. The bent of his mind however is shown by his answer to one who reproached him with prodigality: 'Cæsar, at my age, owed six times as much as I.' His conduct made him an object of suspicion to the court; and though on the first breaking out of the disturbances of the Fronde he rendered active and valuable assistance to the royal cause, still his sincerity was not credited; and he was driven by the distrust of the court, co-operating with his own ambition, to become, not indeed the avowed leader, but the moving spirit of the popular party. 'Before noon to-morrow,' he said, when his resolution was formed, 'I will be master of Paris:' and he kept his word. This was the eminence to which the dreams and studies of his youth had led him to aspire. 'I am convinced,' he says in his Memoirs, 'that it requires greater qualities to be a good party leader, than to be emperor of the universe.' Throughout the wars of the Fronde, a busy period of domestic contest, he maintained his ascendency [FRONDE]; and he has earned from one of his biographers the praise of being the only person who in those troubles sought not gain, but reputation. The praise of generosity towards his bitterest personal enemies is also due to him. The war was closed by the return of the court to Paris, in October, 1652. Tempting offers were made to induce Gondi, who had now risen to the rank of cardinal, to quit his see and repair to Rome, with the title of ambassador; but while he hesitated, and sought to make terms for his friends, he was arrested, Dec. 19, without resistance on the part of the Parisians, who, by this time, were well wearied of civil war. For some time he was very closely confined at Vincennes. By resigning his archbishopric however, to which he had now succeeded by the death of his uncle, he purchased his removal to the château of Nantes, from which he effected his escape into Spain (1654), with singular boldness and good fortune. From Spain he repaired to Rome, where, in spite of the opposition of the cardinals attached to France, he supported the consideration due to his talents, and, it is said, decided the election of Pope Alexander VII. Having revoked his resignation, he maintained during some time his vicars in the administration of the archbishopric; and at last, by its surrender in exchange for other benefices, after leading for some years a wandering life, he effected his reconciliation with Louis XIV., and his restoration to France. The remainder of his life was spent chiefly in retirement, in works of charity and piety. He sold his estates, and, reserving a sum sufficient for his maintenance, devoted the bulk of his revenues to the payment of his debts; which he thus liquidated, to the great amount, as it is calculated, of more than four millions of francs, modern money. Mad. de Sévigné, who was intimate with him during his latter years, speaks with enthusiasm of the charms of his conversation, the elevation of his character, and his mild and peaceable virtues. We must conclude therefore that reflection and adverse fortune had worked a great and salutary change in his disposition. He died at Paris, Aug. 24, 1679.

His political writings, being chiefly of the nature of pamphlets, are forgotten: as an author, his reputation rests on his Memoirs, written, Voltaire says, with an air of grandeur, an impetuosity and inequality of genius, which are the picture of his conduct. The memoirs of Joli, the cardinal's secretary, also contain copious materials for the biography of De Retz.

The following character of De Retz is from the pen of his political adversary the celebrated Duc de la Rochefoucauld:—'Paul de Gondi has great elevation of spirit, and more ostentation than real greatness of courage . . . He appears ambitious, without being so: vanity has prompted him to great attempts, almost all of them at variance with his profession. He has raised the greatest troubles in the state, without any regular plan of profiting by them; and far from declaring himself the enemy of Mazarin, to occupy his place, his only object has been to appear formidable to him, and to please himself by the false vanity of being in opposition to him. He has borne his imprisonment firmly, and has gained his liberty by his own boldness alone. . . . He has taken part in several conclaves, and his conduct has always increased his reputation. His natural turn is to indolence: he labours with great activity in the matters which press on him, and reposes carelessly when they are finished. That which has most contributed to his reputation, is the knowledge how to set his faults in the best light.'

REUCHLIN, JOHN, an eminent German scholar, was born in 1455, at Pforzheim, in the dominions of the margrave of Baden. He was admitted in boyhood as a chorister of that prince's chapel, and, having gained his notice by aptitude in learning, was sent by him to Paris in 1473, as companion to his son. At Paris, Reuchlin prosecuted his studies with advantage, especially in Greek; and not to follow minutely his wandering course, we find him successively at Basle, Orleans, Poitiers, and lastly, Tübingen, where, having previously taken his degree in law, he commenced practice as an advocate, about 1481. In 1482 he visited Rome, and other of the chief towns of Italy, as secretary to the count of Würtemberg, enjoyed and profited by the society of the most learned men of the age, and was received at the court of Lorenzo de' Medici with distinguished respect. On his return to Germany, he took up his abode at Stuttgard; and, from 1484 to 1509, filled a variety of high legal and diplomatic functions. In the latter year he became entangled in a long and harassing dispute, arising out of an edict obtained by Pfefferkorn, a converted Jew of Cologne, authorising him to examine and burn all Jewish books containing anything against the Christian religion. Reuchlin, on being referred to, gave his opinion decidedly against the justice of this measure; and in answer to a work of Pfefferkorn, entitled 'Speculum Manuale,' wrote the 'Speculum Oculare,' in 1511. This book was censured by the Cologne, Paris, Louvain, and other universities, and involved him with the Inquisition, before which, in 1513, he was summoned to appear at Mainz. Reuchlin appealed to the pope; and the pope referred the matter to the bishop of Spire, who pronounced the 'Speculum Oculare' to be neither dangerous to the church nor favourable to Judaism. Still the universities persisted in their condemnation, and even ordered the book to be publicly burnt; and in 1516 the cause was still in course of hearing at Rome, when it was stopped by the pope, and the disputes consequent on the rise of the Reformation prevented its being revived. In the troubled times which followed, Reuchlin had his share of distress and poverty. In 1518 he accepted, and held for a short time, the Greek and Hebrew professorships at Wittenberg; and he afterwards taught Greek and Hebrew at Ingolstadt for somewhat less than a year. In 1520 or 1521 he was appointed to the same chairs at Tübingen, a pleasant gleam over the close of his troubled life; for every comfort and facility were afforded to him, and crowds of students from all parts of Germany testified the respect in which his name and learning were held. Infirmity and sickness however soon compelled him to resign this employment, and he died at Stuttgard, June 30, 1522.

As a scholar, Reuchlin's name stands high among the men of his age. He was suspected of a leaning towards the Reformed doctrines, which the liberality of his views on the Jewish question no doubt tended to confirm. Be this as it may, he never separated himself from the Roman church. His numerous writings comprehend some elementary works on Hebrew, esteemed in their day, but of course long since obsolete; and some treatises on the cabalistic art. His fluency and purity in speaking both Greek and Latin were great, and highly admired.

REUSS is a principality in the interior of Germany, consisting of a part of the antient Voigtland, which was governed by the ancestors of the princes and counts of Reuss. It is situated between 50° 20′ and 51° N. lat., and between 11° 40′ and 12° 20′ E. long. It is divided by the circle of Neustadt, which belongs to Saxe-Weimar, into two portions, of which the southern is much the largest; the lordships of Greitz, Burg, Schleitz, and Lobenstein, with the bailiwick of Saalburg, form the southern portion, bounded on the north and east by Saxony and Saxe-Weimar, on the south by Bavaria, and on the west by Saxe-Coburg and Schwarzburg Rudolstadt. The principality of Gera, which is the northern part, is bounded on the north by Prussia, on the south by Saxony, and on the east and west by the different parts of Altenburg. The area of the whole is 580 square miles, and the population in 1838 was 101,800.

The country, especially the southern part, is mountainous, being traversed by the Erzgebirge and the Thüringerwald, here called the Frankenwald, in which the Sieglitzberg is 2300 feet, and the Culm 2260 feet in height. There are many extensive well-cultivated valleys, of which the two great valleys watered by the Saale and the Elster are the most fruitful. There are also fine forests of pine and other timber, and rich pastures. The natural productions are corn (but not sufficient for home consumption), garden vegetables, fruit, hops, flax, and timber; horned cattle, sheep, game, and fish. The mineral kingdom yields iron, copper, lead, some silver, alum, gypsum, vitriol, and salt. The inhabitants are very industrious, and have manufactures of woollen, calico, stockings, hats, earthenware, china, tobacco, alum, vitriol, and have breweries and iron-works. [GERA.] They carry on a considerable trade with the adjacent countries; they export also cattle and timber. The public schools are on a good footing; there is a high school at Gera, a lyceum at Schleitz, and a Latin school, a seminary for the education of schoolmasters, and another for the clergy at Greitz.

The family of the princes and counts of Reuss is very antient, and may be traced back as sovereign princes to the eleventh century. This family has been repeatedly divided and subdivided into numerous branches; it now consists of two principal lines, the elder and the younger, and some collateral lines. The elder line, that of Reuss-Greitz, possesses the lordships of Greitz and Burg, and part of the district of Reichenfels. The prince resides at Greitz, a town containing 6200 inhabitants. The possessions of the younger line, that of Reuss-Schleitz, are considerably more extensive than those of the elder, but this line being subdivided, the revenue and territory are also divided, though only the prince of Reuss-Schleitz is considered as sovereign.

Branches.	Area of Territory in Sq. Miles.	Population.	Prince's Revenue. £
1. Reuss, elder line . .	143	32,000	14,000
2. Reuss, younger line, viz.:			
a. Reuss-Schleitz .	128	20,500	20,000
b. Lobenstein Ebersdorf . .	163	28,500	18,000
c. Gera . . .	151	30,800	20,000
	585	111,800	72,000

The branch of Gera having become extinct in 1802, the princes of Reuss-Schleitz and Lobenstein administer the affairs of the country in common, and divide the revenue equally between them. All the princes of Reuss have borne the name of Henry ever since the eleventh century. At first they were distinguished by some appellation, such as the elder, the younger, the rich, the fat; and in the sequel by the ordinal numbers. In 1668 it was agreed that the two lines should reckon separately. In 1701 both lines began with the new century with No. I.; but in 1801 the younger line began a new series with No. I., while the elder continue to count on. All the subjects of both lines are Lutherans, except about 500 Moravians and 370 Jews. The government is monarchical, with estates on the antient German model. In 1813 both lines joined the German Confederation; Reuss, together with Hohenzollern, Liechtenstein, Schaumburg-Lippe, Lippe-Detmold, and Waldeck, has one vote (the sixteenth) in the diet of the Confederation; in the full council each line has one vote. The elder furnishes a contingent of 223 men, the younger of 522 men, to the army of the Confederation. Each pays 250 florins annually to the federal treasury.

(Hassel; Cannabich; Stein; Hörschelmann; *Conversations Lexicon.*)

REUTLINGEN is the chief town of a bailliwick of the same name in the circle of the Schwarzwald, in the kingdom of Würtemberg. It is situated in 48° 29′ N. lat. and 9° 12′ E. long., at the foot of Mount Achalm, on the river Echatz, in a beautiful and fertile country. It is surrounded with moats, lofty walls, and towers, and has four principal gates, but within these few years the walls have been broken down in several places. Without the walls there are three small suburbs. The interior of the town is regularly laid out, but it is not a very pleasant-looking place, the houses being neither large nor handsome. Considerable improvements have however been made. The only remarkable building is St. Mary's church, built in the Gothic style entirely of freestone, which was founded in 1273, and finished in 1343. The steeple, which is very handsome, is said to be 325 feet high. Besides St. Mary's there are three other churches. The town-house is a considerable edifice, and the building called the Chancery, formerly a Franciscan convent, but now converted into government offices, is a very large structure.

Reutlingen is a thriving town. The inhabitants, now nearly 12,000, have considerable manufactures of woollen cloths, cotton, leather, hats, cutlery, &c. In the neighbouring country are raised some fruit and corn, in which, as well as in their own manufactures, the inhabitants carry on a considerable trade. Reutlingen was famous as the chief seat of literary piracy in Germany; but this scandalous species of pilfering is now prohibited by law in Würtemberg.

In 1240 Reutlingen, with a territory of fifteen square miles, became a free imperial city, and continuing faithful to the Swabian emperors, bravely defended itself against their adversaries. In 1305 it obtained the right of being a place of refuge for persons who had committed involuntary homicide. It afterwards joined the Swabian Union, and in 1505 placed itself under the protection of Würtemberg, on which it obtained, in 1506, the right of not admitting any Jews. In 1519 Duke Ulrich of Würtemberg besieged and took it, but was expelled by the Swabian Union. In 1530 it was one of the five free imperial cities that subscribed to the Confession of Augsburg. It lost its rights as a free imperial city by the treaty of Luneville, and by the recess of the empire of 1803 it was assigned to Würtemberg.

REVAL, or **REVEL** (in Russian, *Kolywan*, and in Esthonian, *Tatlin*), the capital of the Russian government of Esthonia, is situated in 59° 26′ N. lat. and 24° 35′ E. long., on the Gulf of Finnland. It is very strongly fortified, and in 1824 the harbour was made capable of receiving the Russian Baltic fleet. It has much the appearance of many of the towns of Northern Germany, with narrow irregular streets and dark old-fashioned houses. The best part of the city is the part called the Dom, which is in fact a distinct portion, being surrounded with walls and towers in the old style. It is on an eminence called the Domberg, on the west side of the city, commanding an extensive view of the sea. Most of the houses of the nobility are in this part. There are likewise two extensive suburbs. In all there are 1900 houses, of which 1000 are in the suburbs; and 15,000 inhabitants, a large proportion of whom are Germans. The principal public buildings are the churches, of which there are six Russian, one Roman Catholic, and five Lutheran, including the cathedral, which has a very lofty and handsome steeple.*

There are numerous public and private schools, a gymnasium founded by Gustavus Adolphus in 1631, a theatre, a naval and military hospital, and a Bible society. The manufactures are cotton goods, hats, stockings, leather, powder, starch, needles, earthenware, looking-glasses, &c. There is also a cannon and bell foundry. Reval has a very considerable trade, which is chiefly in the hands of opulent German houses. Above one hundred merchantmen annually arrive in the course of the season, and leave before the winter sets in.

REVELATION (removal of a covering, or discovery) signifies, in theology, a preternatural or extraordinary communication made by the Deity to men. Every communication so made, without limitation as to the subject-matter of it, is of course a revelation; but we shall restrict the use of the term here to communication of knowledge pertaining to religion; that is, knowledge of the relation in which man stands to the Deity, and the will of the Deity respecting him. The fact of a revelation supposes a want, partial or entire, of religious knowledge on the part of man, which he is himself unable to supply. Whether the absence of such knowledge should be attributed to the absence of faculties requisite for attaining it, in the original constitution of man, or to the loss or depravation of those faculties, is a question with which the present subject is not necessarily concerned. It is assumed that he who believes a revelation to have been made, believes it to have been needed; and the admission or denial of this need will materially influence the inquirer as to the amount of other evidence which he may require in support of any particular revelation. A doubt respecting the need will make him cautious in accepting anything which professes to be a revelation. A full persuasion of it will oblige him to accept that which amongst others most recommends itself to his judgment. It is hardly necessary to observe that the fact of a revelation supposes also the being and providence of a God. There must have been an answer to the question whether there is a God, before the question whether he has made a revelation can arise.

The evidence of a revelation may be considered with reference to the party to whom it is first and immediately made; to those who have their knowledge of it immediately from him; [illegible] of it. It [illegible] the only [illegible] ternal to himself, or unequivocal [illegible] judgment of his senses. For so far as we know, or have reason to believe, there is no kind of internal consciousness which alone affords a test by which a preternatural communication may be detected in the mind. It is not meant, nor is it necessary to suppose, that in the case of repeated communications to the same individual there must be a repetition of the external proof. For in the first communication, so ascertained, the means might be given of ascertaining the character of all future communications. When the first recipient communicates what he has received to others, he must produce evidence similar in kind to that which establishes the reality of it to his own conviction; in other words, the miraculous sign must here also accompany the communication, or have previously stamped credibility on the party commissioned to make it. To him this kind of evidence is a security that he is not deceived; to others, that he is neither deceived nor a deceiver. We are supposing a general publication and permanent knowledge of the revelation in the world; for it is conceivable that a few persons to whom the character of the publisher, moral and intellectual, was well known, might not unreasonably be satisfied with his bare assertion of the revelation and the circumstances attending it: but this would obviously be insufficient where the revelation claimed to be received by whole communities aud future generations.

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* Stein's 'Lexicon,' published 1820, says the cathedral was destroyed by lightning on the 28th of June, 1820, but Hörschelmann and Cannabich, in 1833 and 1835, describe it as still existing.

Those who live at a time remote from that in which the revelation was given, must rely, as to the evidence which first established its origin, on historical testimony; which must be tried by the common rules belonging to that subject. If it is asked why preternatural intervention is claimed in behalf of those to whom the revelation is delivered by the first receiver of it, and dispensed with in the case of those to whom only the record of it has descended, the answer is, that a miraculous fact is a subject for historical testimony; and if confirmed by that, conveys to future generations the same kind of security which it was intended to afford to those who witnessed it. It should be observed that in some cases the miraculous character of a revelation may be established subsequently to, and at any distance of time from, its first publication, as in the case of the fulfilment of a prediction; and by any preternatural fact which, however separated in time, is connected necessarily with the revelation.

In saying that a miracle is the proper test of a revelation, we do not mean to exclude every other kind of proof. We mean only that a miracle is that one species of proof which cannot be spared. Many circumstances may be supposed to have place in a revelation, which would contribute greatly to confirm its reality, and which might with some minds have more influence in inducing acceptance than even the proof of miraculous agency.

The matter of a revelation especially is an important element in the general mass of proof on which it should rest; and this perhaps deserves a little further consideration. It may at once be admitted that men, being in the position in which they must be supposed as needing a revelation, cannot know beforehand what this revelation should be. Indeed the very necessity we have supposed for miraculous intervention supposes an inability in the first instance to distinguish, by the mere matter of a revelation, whether it be or be not of divine origin. Neither can it be fairly assumed that men, enlightened by the discoveries of a real revelation, must be competent judges of the internal marks which distinguish it as such, so as to be able to say universally what God would or would not have revealed, and what could have been discovered only by him. For this would require men to be placed in a position which, as objects of a divine revelation, they cannot fairly be supposed ever to occupy. In order to appreciate fully the merits of any system of instruction or moral government, it is obviously necessary that all its ends should also be fully comprehended and appreciated; as in the case of a complicated machine, all the purposes which it is intended to answer must be known, if we would comprehend the use of all the contrivances employed in it. The moral machine which we are considering must be examined from the same elevated point of view from which it is contemplated by its author, before we can assure ourselves that we are competent to sit in judgment on all its provisions. And the case here is not as the case of human instruction, where the learner may [illegible] the teacher. [illegible] have been [illegible] the highest point of knowledge to which [illegible] them capable of [illegible] still [illegible] between the [illegible] of the divine government and the supreme governor not only of the world which they inhabit, but of the universe, of all that is and all that shall be; an interval such that the system of his government can be brought only partially, and to a very limited extent, within the field of human vision. And the connection of that part of his government in which we are placed, with others, cannot be known at all, though the fact of the connection can hardly be doubted. But when all this has been granted, there still remains to the matter of a revelation an important place among the circumstances which may contribute to confirm or disprove its pretensions to a divine origin.

It is not, we believe, disputed that the actual position and prospects of men among existing things, the fact and conditions of their existence, present difficulties which, when considered with reference only to what is, has been, and from experience of the past may be expected to be in the world, admit no solution which will perfectly satisfy inquirers. There are anomalies which perplex and baffle our reason, and there is a want of something to explain or remedy or encourage, which men have not been able to supply; and the supposition of a presiding Providence is of itself so far from removing these difficulties, that it discovers some and aggravates others. Now, whatever coming in the shape of a communication from God should appear to throw light on this darkness, to afford a clew out of the labyrinth, would bring with it a reasonable prejudice in favour of its pretensions; and if, further, from what we know of the history of man, the progress of human knowledge, and the achievments of human intelligence, we might fairly infer that its discoveries were beyond the reach of man's natural powers, then this internal mark would amount to a proof of a very cogent kind. On the other hand, an entire absence of this mark, an entire failure to satisfy our demands on this head, would at least be a discouragement to belief, which it would require the strongest evidence on the other side to overcome.

Again, there may be positive disproof of the pretensions of a revelation from the matter of it. There are notions respecting the deity and moral obligation, the violation of which in a professed communication from God would produce at once a persuasion of imposture which no kind or degree of evidence on the other side could remove. This part of the subject it is not easy to handle satisfactorily, being encumbered with metaphysical as well as moral and theological difficulties. Whether there is in man an innate notion of a deity, and a conscience or moral sense, are questions with which we shall not meddle. It is assumed that men have in fact a notion, however planted or learnt, of a distinction between right and wrong, as something eternal and immutable, and certain persuasions respecting the nature and attributes of the deity, so as to be able to say with confidence that certain things cannot be attributed to God, certain things could not have been taught or commanded by him. This measure of religious knowledge, which we suppose men naturally to possess, or by the use of their natural reason to be capable of attaining, constitutes what is commonly called natural religion, in contradistinction to revealed: and we mean to say that a real revelation cannot be at variance with enlightened views of this natural religion, and must in a certain sense be founded upon it. Men will and should compare the subsequent revelation with the original gift. The comparison indeed will not always issue in the same result. There have ever been among men notions of a deity and moral obligation so discordant and contradictory, that an assigned attribute or command which would recommend an offered revelation to some, would be a disproof to others; and it may be said that when we speak of enlightened views of religion we mean in fact the views which we happen to entertain. Neither can we completely separate by a broad and distinct line genuine moral instincts, or discoveries made by the legitimate use of faculties given to us for the purpose of making them, from prejudices dependent on varying circumstances, and depraved or artificial habits of thought; and it must be acknowledged that whilst none, as we have already observed, can judge universally what is and what is not inconsistent with the notion of a communication from God, there are some who are incapable of judging at all in this matter. Yet

It cannot be said that the test we have proposed, so far as we have admitted its application, is therefore useless and practically unsatisfactory, without disallowing on the same grounds appeals necessarily made and universally accepted in analogous cases which will readily suggest themselves, to natural laws, to the notions, feelings, and opinions of men. Neither is there any real difficulty from the supposed vagueness of the expression when we speak of enlightened views of natural religion. It is probable that the greater number of men now existing believe that the sun and moon are equally distant from the earth. To them a *physical* revelation which confirmed this supposition would not be objectionable, whilst it would be rejected on that ground alone by those who had what we may venture to call more enlightened views of the subject. It would have been tried by them and condemned on the legitimate application of a sufficient test: nor on the trial of a revelation of religious truths ought a test founded on worthy notions of the deity gained from natural religion to be considered less valid because there may have been and still may be whole communities of men capable of accepting a revelation which proposed to them deities in human form, possessing all the human passions, and freely indulging them all. It can hardly be said that we appeal more truly to nature when we appeal to her in a debased rather than in an improved condition; and it may be that those notions to which in a certain state of society we give the preference, ought not to be considered so much in the light of acquisitions made by refinement, as of natural instincts extricated and set at liberty from a state of inaction to which perverted habits had confined them. That in allowing the use of the test in question it is impossible absolutely to fix the limits of a safe and legitimate application, is a disadvantage necessarily belonging to such a subject, from which a process of rigid demonstration is excluded.

We have spoken of a miracle as the test of a revelation, without attempting a definition, believing the common notion of it to be sufficiently accurate for our purpose. For the distinctive character of a miracle, and the possibility of proving it by evidence, the reader may consult the article Miracle in this work, and the authors referred to at the end of it. It is presumed that the purpose of the miraculous test is evident. A certain person is converted to the belief of certain truths by an appearance, undoubtedly miraculous, in the sky. The miracle is to him a proof that his conversion is from God. He teaches to others the truths which he has been made to believe; and in doing this performs miracles. These are a proof to them that he is commissioned by God to teach what he delivers; recorded and duly attested, they prove the same to those who have not witnessed them. All the parties, in accepting the test, would reason in the same manner, namely, that the laws of nature could be changed only by God, the author of them, or by his permission; and that he would not change them or permit them to be changed for the purpose of establishing a falsehood

The question may perhaps be raised, whether, the necessity of a revelation being admitted (and with the proofs of this we have no concern in this article), we must also admit the necessity of its being known to be such by those to whom its contents are proposed. We have shown that the matter of a divine revelation cannot be expected to be fully and altogether subjected to the judgment and expectations of men: and we shall only observe further, that a religion for men who need the interposition of a revelation, must contain not merely abstract truths ending in themselves, but such as convey motives and rules of conduct; which, in order to their practical effect, must be held with the constraining force of a belief that they have been authoritatively proposed by one who has the power to enforce their acceptance.

To the question, 'has a revelation been actually made?' the Christian believes that he has an answer in the possession of the Holy Scriptures, or the books of the Old and New Testament. An account of the contents of these books and an examination of the evidences of the Christian revelation form, of course, no part of the subject of this article. The proofs which we have insisted on as requisite to establish the reality of a revelation generally, must, if rightly assigned, be applicable to this particular one.

We insisted on the primary evidence of miraculous agency in the communication, with corroboration from the matter communicated, the miraculous agency to be so exhibited to the witnesses as to be capable of proof from testimony to others. Particular revelations may be supposed, according to the circumstances under which they were given, and the nature of their contents, to admit various kinds of evidence; almost all of which, however, will probably be found to resolve themselves into one or other of these two, though all inquirers may not agree in the classification. We should place for instance under the head of proof from preternatural manifestations, the fulfilment of prophecy in cases supposed to be beyond the reach of human foreknowledge or conjecture; the attested existence of persons exhibiting qualities, moral or intellectual, in kind or degree, not exemplified or to be expected in others of the human race; conduct of men, natural under the supposition that they were conscious and had proof of a divine commission, but otherwise unaccountable according to any known motives of human action.

The purpose and value of what may be called the corroborative evidence as distinguished from that founded on miraculous agency can hardly be overlooked. Between the highest degree of certainty with which a fact can be invested by evidence, and the faintest probability, there is room for every shade of assurance.

Now it is notorious both that different minds are differently affected by the same evidence, and that some minds seem peculiarly constituted by nature to admit the full force of one mode of proof, whilst they are comparatively insensible to another; so that it might happen that whilst to one inquirer the testimony which supported the story of the miraculous facts seemed so strong as to supersede the necessity of confirming his belief in the revelation by the evidence which the matter of it might supply, and which perhaps he might be little able to appreciate, another might rather feel that the miracles were so far proved as to complete the satisfaction which he had already derived from the other source.

The Christian revelation, which may be considered as forming one subject with the Jewish, from the wide field over which it is spread and the miscellaneous character of its contents, must necessarily supply, in large abundance, matter for examination in the way of evidence. An enumeration, which however does not pretend even to approach completeness, of the constituent parts of the body of evidence belonging to it, together with the proper mode of using them and estimating their joint force, may be found shortly but very clearly proposed in the first of Mr. Davison's 'Discourses on Prophecy.' Before we leave this part of the subject, we would observe, what seems sometimes to be overlooked, that an action may itself be a revelation. It would not be improper to say that the birth, death, and actions, even more than the discourses of Jesus Christ, were a revelation, of which the Apostles, who taught what are called the doctrines of Christianity, were only the interpreters. Of these doctrines it is not our business to treat, but we will select one as the subject of a few observations, merely with a view to illustrate what was said in a former part of this article, on the disposition of mind with which we must necessarily regard the pretensions and evidences of a professed revelation, according as we recognise, or not, a need which men have of extraordinary information on the subject of religion. The doctrine we select is that of the immortality of the soul and a future state of rewards and punishments. Without assuming the probability or improbability of this doctrine, we suppose it to be notorious that the immortality of the soul, or some kind of continued existence after bodily death, with liability to a state of happiness or suffering, has been very generally believed, in one shape or other, in all parts and at all periods of the world; and that this doctrine is distinctly delivered and prominently set forth in the New Testament. There is as little doubt that before the time of Christianity, either the notions commonly received of a future state were so irrational, or the belief of it so faint and unassured, that for the most part it had comparatively little effect on the moral feelings and conduct of men; and that on the other hand, wherever the Christian revelation has been published, this doctrine, whether true or false, has not only been firmly received with little variation in the manner of understanding it, but has influenced the conduct of many, happily or not, in the most important respects, and regulated the whole course of their lives. It is plain that those who regarded the distinct and authoritative announcement of this doctrine to be among the things especially needed by mankind, and those who considered it to be either useless or mischievous, would be very differently impressed by the general body of evidence in favour of the revelation.

Among professed revelations which have been the ground of a national religion, it may be doubtful whether we should place the mythological systems of antient Greece and Rome. They are indeed avowedly founded on traditional accounts of certain transactions between gods and men; but from the nature of the transactions, of the supernatural beings concerned in them, and the purposes of the interference, we may doubt whether the discoveries supposed to be made belong to the notion of a revelation according to our definition of the word, or the usual acceptation of it. The same for the most part may be said of the mythology of the Hindus and of the northern nations of Europe. But there can be no doubt that the religion of Mohammed, as taught in the Korán, professes to be founded on a revelation in the strict sense of the word, such as may be subjected to the same tests which we have supposed to be applicable to all revelations.

In passing from the Christian revelation itself to the written record of it, a new and important question is opened to us. The revelation may have been made to the persons who profess to have received it; but in recording it also, were they preternaturally assisted, or were they left to the use of their natural memories, and the guidance of their unassisted judgment? In other words, we are met by a question respecting what is called the inspiration of the books of Scripture, or, more properly, of the persons who wrote them. By this word we are to understand, not the preternatural infusion of revealed truths into the minds of the writers (which however would not be inconsistent with the original meaning of the word), but preternatural assistance in recording what had been so infused. This distinction should be observed. St. Paul, if we believe his own declaration, received immediately from God a message to men. He may be supposed to have delivered this message orally or in writing to others from memory; and in that case he would have been a deliverer and they receivers, in the strictest sense of the words, of a divine revelation; but the message, so delivered would not in theological language have been an inspired message, that is, spoken or written under inspiration. It is beside our purpose to defend or impugn the doctrine of the inspiration of Scripture generally, or, out of the various theories which have been put forth, to advocate one in preference to the others. We only wish to do something towards clearing away certain fears and difficulties, which seem to beset and mislead many in the very outset of the inquiry, and to offer a few suggestions as to the principle on which the inquiry should be conducted, to those who are not very conversant with the subject.

In the case of most persons educated in the Christian faith, their first introduction to the Bible is accompanied by an assurance that it was dictated by God, and is *therefore* true; and this is told them at a time when its claims, as an authentic history, independently of its inspiration, neither are nor can be explained to them. This early impression, perhaps unavoidable, that the Scriptures are to be received as true, *only* because they are the Word of God, is probably retained for the most part without question, in spite of its inconsistency with the method and object of books which are given, almost as universally as the Bible, to all educated persons for the purpose of establishing their faith on rational grounds. Hence they are habituated from the very nursery to confound in their minds two questions essentially distinct, the divine origin of the Christian religion, and the divine origin of the scriptural records of it. All might easily remove this confusion by simply answering the question, what would be the natural course of our inquiries, and by what steps should we arrive at conviction of the divine origin of the Christian religion, if the volume of the New Testament were for the first time put into our hands for examination, at an age when we were capable of making it? It is obvious that we should not begin with assuming the inspiration of the writers; for that would be assuming the very point in debate, assuming that for which we had not as yet a shadow of evidence. But neither is it of their inspiration that it would be our first object to find evidence; for such evidence could not at first be obtained. If we ever came to the conclusion that they were inspired, it must be because either the very supposition of a revelation from God included in it the supposition of a revelation on the part of those who communicated it, or because all the writers themselves claimed inspiration, or some, whose claims we had already allowed, attributed it to the rest. In the former case we must *first* have believed that a revelation was made; in other words, that the origin of the religion was divine: in the other, if we assent to the claim of inspiration, we must *first* have admitted the credibility, the veracity of those who make it; that is, if we believe them to be inspired because they say so, we must have had reason for believing what they say, on other ground than that of their inspiration. It seems then that it would be our first object to establish not the inspiration, but the credibility of the sacred writers apart from their inspiration. We should proceed from the establishment of their credibility, to inquire, in the second place, if they were inspired. The result, in short, to which we have actually come is this: the New Testament is put into our hands for examination, and we find that the claims of Jesus and his followers to a divine commission rest on the miracles which they are said to have performed. Our belief of the fact of the miracles depends on the credit we attach to the story of the witnesses. If that is substantially true, Jesus came from God. With the arguments by which the credibility of the gospel history is proved we have here no concern. It is plain that it is not proved by the inspiration of the authors. Some confusion seems to have arisen from a strange mistake respecting the kind of satisfaction which the inspiration of the sacred writers, when established, is capable of supplying. It does not confirm their veracity, it only implies their accuracy. It secures us from their mistakes, not from their falsehood. Now if it should be argued that without inspiration we can have no assurance that they were not mistaken, when they tell us that they saw a man dead on the cross, laid in his grave, and afterwards alive, it may be asked, how can they be secured from their liability to mistake, when they tell us that they are inspired? It is at least as likely that they should be mistaken in the one case as in the other. The obvious truth is, that if we cannot rely on their veracity when they vouch for miracles, we can trust none of their assertions, and admit none of their claims; and if they might be mistaken as to the fact of a miracle, they might be equally mistaken in their claim of inspiration for themselves or for others.

It is hardly necessary to observe that the various methods followed by writers on the evidences of the Christian religion are all in conformity with the view that has been taken of this subject. They endeavour to show the genuineness and authenticity of the books of the New Testament, the fidelity, disinterestedness, and integrity of the writers; to point out their means of information as human historians, and to confirm the accuracy of their accounts by comparison with other records. The question of inspiration forms no part of their inquiry. It is beside their object, which is to prove the divine origin of Christianity; and this is fully proved if their arguments are satisfactory.

It is not meant, of course, that all who are brought to a conviction of the truth of Christianity, arrive at it in the same manner. It is sufficient for our argument that it may be reached in the manner we have supposed. In short, on whatever support the believer himself may eventually feel that his faith habitually reposes, if he should ever be impelled by any motive to trace his conviction to a source from which it can be shown to others by reasoning that it may legitimately flow, he will find that he must rely, in the first instance, on the credibility of the sacred writers, however established, considered as uninspired historians. With this foundation laid he may commence an inquiry into the proofs of their inspiration; and he may pursue it with a full assurance that to whatever result it may lead, the divine origin of his religion is already secured; that he has in possession a revelation from God, truths divinely communicated to men. We may seem to have taken unnecessary pains to establish a point too plain to be disputed. Our justification must be, that it does not seem to have been so plain to some even of those who have written on the subject, and are occasionally quoted as authorities, and who have been led, apparently by the confusion which we deprecate, into unwarrantable insinuations of infidelity against those who differ from them in opinion.

If the question should be asked, where, when the divine origin of the religion is supposed to be established on the credibility of the sacred writers, we should look for proof that the books which are the records of it were written under the security of inspiration? the natural answer would be that it must be looked for in the books themselves, from the claims, declarations, and intimations of the writers. When, for example, one of the evangelists has recorded a distinct promise made by their master to his Apostles, of a divine gift for the declared purpose of assisting the memory and enlightening the understanding, the inference seems to be unavoidable that those to whom the promise was given must have written with more than natural advantages. The argument founded on the necessity of inspiration to render the sacred books effectual for the purpose for which they were intended, ought not perhaps to be slighted. We have seen indeed that the supposition of the divine origin of the religion does not necessarily require the admission of inspiration; yet the peculiar character of the contents of the books, together with the service they were destined to perform, may raise a presumption in its favour. The direct testimony however from the writers themselves must be principally regarded. But when commencing the examination, whilst the evidence is yet to be found, we must be careful to estimate correctly the degree of authority which ought in this stage of the inquiry to be attributed to the words of Scripture. They are not yet proved to be the words of God. The declarations of the writers must be received and interpreted fairly and liberally, as the solemn declarations on a solemn subject, of honest and credible writers, ought to be received and interpreted. If the evidence which we seek to obtain from them cannot be obtained in this manner, it cannot be obtained at all. To search Scripture for proofs of its inspiration whilst at the same time we assume it to be inspired, is a proceeding so obviously absurd, that if experience did not teach us otherwise, any caution against it would seem to be unnecessary. But even when this strange error is not committed, declarations of the sacred writers, apparently bearing on this subject, may be and often are improperly summoned to the cause. When a writer professes to have received secret suggestions from the deity, that is, to be the subject of inspiration in one sense of the word, he is represented as claiming it in the other, as though the privilege of receiving communications necessarily implied the privilege of infallibility in recording them. This confusion has been noticed on another occasion.

That most popular argument for the inspiration of a particular book, founded on testimony borne to the purity and integrity of the canon of Scripture, may be soon disposed of. When it has been proved that a book forms part of what is called the canon, it may follow that it forms part of Scripture. This will not carry us far when the question to be decided is, what are the claims of Scripture to inspiration?

There is one mode of proof, besides those already mentioned, which ought perhaps to be noticed, as being much in favour with some theologians, namely, an appeal to what is called the tradition of the church. There are some advocates of inspiration, in the strictest sense and most unlimited application of the term, who allow, or rather contend, that the proof of it rests mainly, if not entirely, on the testimony of tradition. An examination of the value of this testimony would oblige us to enter more largely, than would here be expedient, on the important question of ecclesiastical tradition generally. We shall content ourselves with saying that, in this case at least, we greatly doubt, for many reasons, the sufficiency of the witness, and are not satisfied, even where it speaks to the purpose, that its words have always been rightly understood. However this may be, it is plain that this mode of proof also supposes the question of the divine origin of the Christian religion to be independent and to have precedence of the question of inspiration.

We shall close this article with a brief notice of the three most popular theories of inspiration, which are distinguished from each other more in respect of the extent to which they attribute inspiration, than in respect of any difference in the meaning assigned to the word.

That which is called verbal inspiration supposes each word in the Bible, as we now have it, with due allowance made for mistakes of transcribers, to have been irresistibly dictated by the Spirit of God, the writers being only vehicles of words and thoughts not their own. This notion of inspiration has undoubtedly still its advocates; but we are not aware that it is at present maintained by any divine of repute. According to another theory, somewhat modifying the former, the writers were allowed to exercise their own judgment in the choice of their words; but in the meaning of each sentence, from the first verse of Genesis down to the last of the Revelations, they have been secured by supernatural interference from the least particle of error. This theory, which is not without support from well-known theologians, represents perhaps more nearly than any other the popular creed. Lastly, there are many, and amongst them divines of great eminence and reputed orthodoxy, and not a few distinguished prelates of the English church, who limit the extent of inspiration as commonly received, and suppose that parts of Scripture may have been written with the liability to error incident to ordinary histories; those for instance which are purely historical, and contain no religious truth. As to the degree in which this limitation is to be admitted, and the number and length of passages to be excepted from the sanction of inspiration, there is of course room for diversity of opinions, which affords apparent ground for objection to the theory itself. The advocates of the two former theories contend that a latitude for choice is allowed which is capable of a dangerous abuse. The truth of the allegation cannot be disputed; but perhaps it is not possible by any device to exclude the danger which alarms them. The canon of Scripture has not been ascertained to us by an authoritative revelation, nor has the purity of the text been absolutely secured by providential interference. A liberty is thus left, which in these cases also may become dangerous to those who are willing to abuse it. Some however may think that the test of sincerity and right intention, and the means of probationary discipline which the allowance of such a measure of discretion affords, is apparently in harmony with what we have been taught of God's moral government of the world. On the other hand it is objected to the advocates of the more rigid theories, that the faith of the believer is exposed to still greater danger by the forced constructions and violent treatment of the text which their systems have often induced them to employ.

It is plain that reliance on the truth of the Scriptures generally, as containing a divine revelation, can in no respect be strengthened by the belief in plenary inspiration. On the other hand, since those who have identified in their minds the plenary inspiration with the truth of the Bible, must with the one abandon the other, the indisputable detection of even a geographical or chronological error, however unimportant in itself, of a discrepancy between the sacred writers, irreconcileable by any legitimate process, as to a single circumstance, however minute and trivial, in recording the same fact, must destroy their faith; and hesitation as to the possible removal of such difficulties must impair or disturb it. It is absurd to suppose that any theory of inspiration can reconcile us to such a quantity of error as would overthrow the credibility of ordinary historians; for the presence of it in the Scriptures would be fatal to the only evidence on which their inspiration in any sense can be reasonably maintained.

It might perhaps have been expected that we should notice a certain classification of the phenomena of inspiration of which many theologians are fond, certain distinctions in kind, under the titles of impulsive, suggestive, superintending, and many others. The truth is, we think them to be of very little value on any view of the subject. They seem to have been adopted by theologians who hold the theory of plenary but not verbal inspiration, from a wish to remove the necessity of supposing a greater quantity or degree of miraculous agency than the occasion required.

We have drawn none of our materials from the writings of a class of theologians who, regarding the Scriptures as in some sense, not very clearly defined, vehicles of religious truth, exclude all notion of revelation which is not equally applicable to discoveries made by human intelligence, and who give no credit to assertions of miraculous interposition, whether in conveying knowledge or attesting facts. Whatever consideration may be due to the writers, some of whom are men of ingenuity and research, their speculations could hardly have an appropriate place in the subjects to which this article is confined. [RATIONALISM.]

REVELATIONS, BOOK OF. [APOCALYPSE.]

REVELS, MASTER OF THE, an officer in noblemen's and other great houses, appointed *pro tempore* to manage the Christmas diversions from All-hallow-eve to Candlemas-day; more ordinarily called the *Lord of Misrule*. In the royal household however the master of the revels was a permanent officer, and was called Master of the Tents and Revels or Masks and Revels, whose business it was to keep the tents and pavilions belonging to the king, which were often, if not always, carried with the king upon removes and progresses. This officer had also the keeping of the dresses and masks which were used in entertainments given at court, and [illegible] to provide such new ones as were wanted.

The permanent office of master of the revels was first instituted in the reign of Henry VIII. Queen Elizabeth divided the mastership of the revels into several offices, which, as vacated by death, were to be re-united. In 1663 we find two masters of the toils, tents, hayles (*i.e.* halls or temporary buildings), and pavilions, who again occur in 1674.

See the 'Archæologia,' vol. xviii., p. 318, &c., and 'The Loseley Manuscripts,' edited by A. J. Kempe, Esq., 8vo., Lond., 1836. Various papers in illustration of the office in Queen Elizabeth's time are contained among the Lansdowne MSS. in the British Museum. See also MS. Addit., Brit. Mus., *5750*. No mention of this office has been found subsequently to the reign of King Charles II.

REVERSION. By a reversion, in the widest sense, is meant a right of property the enjoyment of which is to commence at some future period, fixed or depending on contingencies, and is to continue either for ever or during a term either fixed or depending on a contingency: anything in fact which is to be entered on, or which may be entered on, at a future time, is a reversion in books which treat on the value of property. The legal sense of the word is more restricted.

Thus an assurance of 100*l.*, or a contract to pay 100*l.* at the death of a given individual, is 100*l.* in reversion to the executors of that individual. Our object in this article is to treat of this most common species of reversionary contract, life insurance or assurance. At the time when the article INSURANCE should have appeared, the mania for forming new companies was at its height, which made us judge it advisable to defer the consideration of the subject, that the list which we proposed to give of such companies might be more complete.

The value of a reversion depends in a very easy manner upon the value of the corresponding annuity; that is, any given sum, say 100*l.*, to be received *when* a given event arrives, depends for its value upon that of 100*l.* a year to be received *till* the event arrives. Suppose, for example, that money makes five per cent., and that an annuity, say upon a life, is worth 14 years' purchase, upon the method of calculation explained in ANNUITY, p. 49. That is, 100*l.* paid a year hence, and again two years hence, and so on as long as the life lasts, is now worth 1400*l.* Required the value of 100*l.* to be paid at the end of the year* in which the life drops. We must now reason as follows:—Suppose a perpetual annuity of 100*l.* a year is to be enjoyed by A during his life, and by his legatees after him. By hypothesis A's portion is now worth 1400*l.*, and (money making five per cent.) the annuity for ever (INTEREST) is worth 20 years' purchase, or 2000*l.*; consequently the legatees' interest is *now* worth 2000 − 1400, or 600*l.* But at the end of the year of death the legatee will come into 100*l.* current payment, and a perpetual annuity worth 2000*l.*; for the remainder of a perpetual annuity is also a perpetual annuity: his interest will *then* be worth 2100*l.* Hence we have ascertained that 2100*l.* at the end of the year of death is now worth 600*l.*; and the rule of three then gives the value of any other sum: thus 100*l.* at the end of the year of death is now worth $\frac{200}{7}$*l.*, or 28*l.* 11*s.* 5½*d.* Hence the following easy

RULE.—To find the value of a given reversion, subtract the value of the same annuity from that of a perpetual annuity, and divide the difference by one more than the number of years' purchase in a perpetual annuity: or multiply the excess of the number of years' purchase in a perpetual annuity over that in the life annuity by the reversionary sum, and divide as before.

Next, to find what premium should be paid for the reversion. A premium differs from an annuity in that a sum is paid down, and also at the end of every year: consequently it is worth one year's purchase more than an annuity. In the preceding question, the annuity was worth 14 years' purchase; consequently the premium now is worth 15 years' purchase. But the present value of all the premiums is to be also the present value of the reversion, or 28*l.* 11*s.* 5½*d.*, whence the premium should be the 15th part of this, or 1*l.* 18*s.* 1*d.* Hence to find the premium, divide the present value of the reversion by one more than the number of years' purchase in the life annuity. But when, as most commonly happens, the premium is wanted without the present value, the following is an easier

RULE.—Divide the reversionary sum separately by one more than the number of years' purchase in the perpetual annuity, and one more than the number of years' purchase in the life annuity: the difference of the quotients is the premium required. Thus if in the preceding example we divide 100*l.* by 20+1 and by 14+1, or by 21 and 15, we find 4*l.* 15*s.* 3*d.* and 6*l.* 13*s.* 4*d.*, which differ by 1*l.* 18*s.* 1*d.*, the same as before.

The life we have been tacitly considering, when we talked of an annuity being worth 14 years' purchase, at five per cent., is one of about 36 years of age. The first impression must be, that the proposed premium is ridiculously small. Make it up to 2*l.*, and it will be 50 years before the premiums reach 100*l.* Some such consideration must have moved the law officers of the crown, in 1760, when they refused a charter to the Equitable Society, then charging a premium of about 4*l.* at the age of 36, on account of the lowness of their terms. But it is to be remembered that those who receive the premiums are to invest them immediately at five per cent., and are to invest the interest, thus making compound interest; persons aged 36 live, one with another, about 30 years, which is sufficient time for the premiums, with their interest, to realize 100*l.* for each person, one with another.

We now show the manner in which a simple result of calculation answers its end. To simplify the case, suppose an office starts with 5642 individual subscribers, each aged 30 years, the mortality among them being that of the Carlisle Table. [MORTALITY, p. 416.] The bargain is for a short assurance, as it is called, of 20 years, and of 1000*l.*: that is to say, the executors of each one who dies within 20 years are to receive 1000*l.* at the end of the year of death. Money makes three per cent. once a year. According to the table then, there are 57, 57, 56, &c. deaths in the successive years, and the following is the result, the proper premium being calculated at 11*l.* 12*s.* 3½*d.* each person, or more exactly 11,614*l.* 16*s.* for 1000 persons. It is supposed that there are no expenses of management. By P is meant that premiums are paid, and the number paid precedes the letter: by *y*, that a year's interest is received, and by *c*, that claims, in number as stated, are paid; small letters denote a transaction at the end of a year, and the large letter one at the beginning; the age of the parties paying premiums is in parentheses at the beginning. Fractions of pounds are neglected, one pound being written for everything above ten shillings.

	£		£
(30) 5642 P	65530	Bt. over +	42783
y	1966	(34) 5417 P	62917
	67496		105700
57 *c*	57000	*y*	3171
	10496		108871
(31) 5585 P	64869	55 *c*	55000
	75365	+	53871
y	2261	(35) 5362 P	62279
	77626		116150
57 *c*	57000	*y*	3485
+	20626		119635
(32) 5528 P	64207	55 *c*	55000
	84833	+	64635
y	2545	(36) 5307 P	61640
	87378		126275
56 *c*	56000	*y*	3788
+	31378		130063
(33) 5472 P	63557	56 *c*	56000
	94935	+	74063
y	2848	(37) 5251 P	60989
	97783		135052
55 *c*	55000	*y*	4052
+	42783		139104

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* Assurance companies usually pay in a few months after proof of death, which gives a trifling advantage to the assured, not worth considering in a very elementary statement of the question.

	£
Bt. over	139104
57 c	57000
+	82104
(38) 5194 P	60327
	142431
y	4273
	146704
58 c	58000
+	88704
(39) 5136 P	59654
	148358
y	4451
	152809
61 c	61000
+	91809
(40) 5075 P	58946
	150755
y	4523
	155278
66 c	66000
—	89278
(41) 5009 P	58179
	147457
y	4424
	151881
69 c	69000
—	82881
(42) 4940 P	57378
	140259
y	4208
	144467
71 c	71000
—	73467
(43) 4869 P	56553
	130020
y	3901
	133921
71 c	71000
—	62921

	£
Bt. over	62921
(44) 4798 P	55729
	118650
y	3560
	122210
71 c	71000
—	51210
(45) 4727 P	54904
	106114
y	3183
	109297
70 c	70000
—	39297
(46) 4657 P	64090
	93387
y	2801
	96188
69 c	69000
—	27188
(47) 4588 P	53288
	80476
y	2414
	82890
67 c	67000
—	15890
(48) 4521 P	52510
	68400
y	2052
	70452
63 c	63000
—	7452
(49) 4458 P	51779
	59231
y	1777
	61008
61 c	61000
	8

At the outset the office receives 65,530*l.* from the 5642 persons assured; this is immediately invested at 3 per cent., and yields 1966*l.* by the end of the year, making 67,496*l.* But at the end of the year the claims of the executors of 57 persons who have died during the year are to be satisfied, which requires a disbursement of 57,000*l.*, reducing the society's accumulation to 10,496*l.* The contributors who are left, 5585 in number, now pay their second premiums, 64,869*l.*, so that, these being immediately invested, the company has 75,365*l.* at interest during the second year. This yields 2261*l.*, so that by the end of the year 77,626*l.* is accumulated. Then comes the demand of 57,000*l.* on behalf of 57 contributors deceased during the year, which reduces the accumulation to 20,626*l.* This is more than it was at the same time last year, which is denoted by +. In this way the company goes on, accumulating to an amount which would lead a person unacquainted with the subject to conclude that the premium must be too large: in fact ten years give an accumulation of 91,809*l.* But now the state of affairs begins to change; the contributors have been diminishing, while the claims have been increasing, until the yearly incomings no longer equal the outgoings. The accumulations then come in to make good the difference in such manner that by the time the remaining contributors come to be 50 years of age, and the claims of 61 who died in their fiftieth year have been satisfied, there only remains 8*l.* of the 91,809*l.*; and this 8*l.* is merely the error arising from omitting shillings, &c. in the calculation. Something of the same kind must take place in every office which dies a natural and a solvent death; the only difference being that, when new business ceases, instead of a number of contributors all of the same age, and under similar contracts, both ages and contracts vary considerably.

There are certain tables which are variously named (sometimes after Mr. Barrett, the inventor, sometimes after Mr. Griffith Davies, the improver; sometimes after D and N, letters of reference used in them), but which we call commutation tables. They are described in the 'Treatise on Annuities,' in the *Library of Useful Knowledge*, and a copious collection is given: also in an article in the 'Companion to the Almanac' for 1840. They very much exceed in utility those which preceded them; and we shall here give part of one of them, namely, that for the Carlisle Table, at 3 per cent., which contains the materials for judging of the demands made by an insurance company in cases involving one life only. Opposite to each age of life are three rows of figures in columns marked D, N, and M: and by M (x) we mean the number in column M opposite to the age x.

Age.	D.	N.	M.	Age.
0	10000·00	173198·26	4664·129	0
1	8214·56	164983·70	3169·954	1
2	7332·45	157651·25	2527·103	2
3	6656·74	150991·51	2064·957	3
4	6217·63	144776·88	1819·735	4
5	5863·15	138913·73	1646·351	5
6	5591·04	133322·69	1545·0149	6
7	5361·53	127961·16	1478·3414	7
8	5159·58	122801·58	1432·5557	8
9	4976·34	117825·24	1399·5998	9
10	4806·85	113018·39	1375·0447	10
11	4645·89	108372·50	1354·0945	11
12	4488·83	103883·67	1332·3517	12
13	4336·30	99547·37	1310·5613	13
14	4188·18	95359·19	1288·7444	14
15	4043·73	91315·46	1266·2792	15
16	3901·65	87413·81	1241·9757	16
17	3762·60	83651·21	1216·5650	17
18	3627·75	80023·46	1191·3070	18
19	3497·56	76525·90	1166·7847	19
20	3371·89	73154·01	1142·9766	20
21	3250·56	69903·45	1119·8620	21
22	3133·96	66769·49	1097·9425	22
23	3021·40	63748·09	1076·6614	23
24	2912·74	60835·35	1056·0002	24
25	2807·84	58027·51	1035·9408	25
26	2706·12	55321·39	1016·0019	26
27	2607·95	52713·44	996·6438	27
28	2512·32	50201·12	976·9753	28
29	2417·93	47783·19	955·7580	29
30	2324·43	45459·76	932·6867	30
31	2233·93	43224·83	909·8874	31
32	2146·73	41078·10	887·7522	32
33	2063·09	39015·01	866·6387	33
34	1982·87	37032·14	846·5062	34
35	1905·57	35126·37	826·9601	35
36	1831·09	33295·48	807·9833	36
37	1759·00	31536·48	789·2243	37
38	1689·22	29847·26	770·6864	38
39	1621·71	28225·55	752·3727	39
40	1555·78	26669·77	733·6727	40
41	1490·82	25178·95	714·0293	41
42	1427·46	23751·49	694·0911	42

Age.	D.	N.	M.	Age.
43	1365·96	22385·53	674·1706	43
44	1306·84	21078·69	[illegible]	44
45	1250·10	19828·59	[illegible]	45
46	1195·62	[illegible]	618·0875	46
47	1143·60	[illegible]	600·8886	47
48	1094·08	[illegible]	584·6747	48
49	1047·41	15347·98	569·8728	49
50	1003·99	14344·99	554·9583	50
51	[illegible]	13384·278	[illegible]	51
52	[illegible]	12464·683	529·4612	52
53	879·047	11585·836	515·9924	53
54	839·663	10746·173	502·2108	54
55	801·433	9944·740	488·4371	55
56	764·144	9180·596	474·4914	56
57	727·792	8452·804	460·3956	57
58	691·828	7760·976	445·6299	58
59	655·419	7105·557	429·3712	59
60	618·338	6487·219	411·3795	60
61	580·223	5906·996	391·2752	61
62	543·165	5363·831	371·1165	62
63	507·618	4856·213	351·3896	63
64	473·982	4382·231	332·5389	64
65	441·875	3940·356	314·2372	65
66	411·379	3528·977	296·6107	66
67	382·422	3146·555	279·6357	67
68	354·803	2791·752	263·1551	68
69	328·468	2463·284	247·1545	69
70	303·240	2160·044	231·4936	70
71	279·203	1880·841	216·2889	71
72	255·119	1625·722	200·3366	72
73	230·813	1394·909	183·4619	73
74	206·585	1188·324	165·9566	74
75	182·483	1005·841	147·8717	75
76	160·245	845·596	130·9482	76
77	139·558	706·038	114·9284	77
78	120·936	585·102	100·3722	78
79	104·637	480·465	87·5951	79
80	89·5602	390·9053	75·5660	80
81	76·3678	314·5375	64·98221	81
82	64·2223	250·3152	55·06098	82
83	53·5795	196·7357	46·28874	83
84	44·1701	152·5656	38·43998	84
85	36·0741	116·4915	31·63048	85
86	28·8845	87·6070	25·49154	86
87	22·6179	64·9891	20·06629	87
88	17·2112	47·7779	15·31836	88
89	13·0366	34·7413	11·64505	89
90	9·92975	24·81154	8·91787	90
91	7·12856	17·68298	6·40590	91
92	4·94352	12·73946	4·42849	92
93	3·45567	9·28379	3·084616	93
94	2·48520	6·79859	2·214797	94
95	1·80961	4·98898	1·611594	95
96	1·34696	3·64202	1·201650	96
97	1·02344	2·61858	·917362	97
98	·772823	1·845761	·696555	98
99	·589532	1·256229	·535773	99
100	·468295	·787934	·431707	100
101	·353621	·434313	·330672	101
102	·245230	·189083	·232590	102
103	·142852	·046231	·137345	103
104	·046231	·000000	·044884	104

To find the value of an annuity of 1*l.* on a life of any age, divide the N of that age by its D. Thus, at the age of 35 the value of an annuity of 1*l.* is N(35)÷D(35), or 35126·57 ÷1905·57, or 18·433*l.*, or 18*l.* 8*s.* 8*d.* Thus, the following formulæ will be readily understood:—

Value of an annuity which is to commence immediately; that is, which is to make the first payment in a year (age x)	$\frac{N(x)}{D(x)}$
Value of an annuity which is to commence in n years; that is, to make the first payment in $n+1$ years, if the party be then alive (present age x)	$\frac{N(x+n)}{D(x)}$
Premium for such an annuity, payable now and n times in all	$\frac{N(x+n)}{N(x-1)-N(x+n-1)}$
The same premium, payable $n+1$ times	$\frac{N(x+n)}{N(x-1)-N(x+n)}$
Value of a life annuity for n years; or payable n times at most	$\frac{N(x)-N(x+n)}{D(x)}$
Present value of an assurance of 1*l.* at death	$\frac{M(x)}{D(x)}$
Premium for the same	$\frac{M(x)}{N(x-1)}$
Present value of an assurance of 1*l.* at death if after n years	$\frac{M(x+n)}{D(x)}$
Premium for the same, payable $(n+1)$ times	$\frac{M(x+n)}{N(x-1)-N(x+n)}$
Present value of an assurance of 1*l.* at death if within n years	$\frac{M(x)-M(x+n)}{D(x)}$
Premium for the same, payable n times	$\frac{M(x)-M(x+n)}{N(x-1)-N(x+n-1)}$

As an instance, let us take the case of the last formula, which was proposed at the beginning of this article: the age is 30, and the term of insurance 20 years; we have then to divide the excess of M(30) over M(50) by the excess of N(29) over N(49):—

M(30)	932·6867	N(29)	47783·19
M(50)	555·9583	N(49)	15347·98
	376·7284	div. by	32435·21 gives ·0116148 :

this is for 1*l.*, giving 11·6148*l.*, or 11*l.* 12*s.* 3½*d.* for 1000*l.*, and 11,614·8*l.* to be the total premium for 1000 persons.

Question.—If the office insure a large number of persons (for the whole life or a term) at the premium p (the age being x), what will be their accumulation in n years, upon the suppositions the working of which has been shown in the example already given; it being supposed that £A is insured to every one who dies? The answer is in the following formula: for every person who, according to the tables, is alive at the end of the term of n years, there is remaining in the office, after all claims have been paid up to the end of the n years, and before the $(n+1)$th premium is paid, the sum

$$\frac{p\left\{N(x-1)-N(x+n-1)\right\}-A\left\{M(x)-M(x+n)\right\}}{D(x+n)}$$

As an example we shall verify the accumulations of 10 years in the instance referred to; in which $p=11·6148l.$, $A=1000l.$, $x=30$, $n=10$.

N(29)	47783·19	M(30)	932·6867
N(39)	28225·55	M(40)	733·6727
	19557·64		199·0140
	×11·6148		1000
	227158·1		199014·0
	199014·0		
	28144·1		

D(40) 1555·78)28144·1(18·09002
×5075
91806·84

The answer is, that the reserve of premiums for each person of the 5075 then remaining is 18·09002*l*., which for the whole is 91806·84*l*. The rough answer in the scheme worked out at length is 91,809*l*.

Now, this 18·09*l*., or 18*l*. 1*s*. 10*d*., is what is called the value of each man's policy at the expiration of the ten years; or the *very utmost* the office could afford to give him to surrender all claim, and to keep his future premiums to himself. But what is the nature of his claim on the office? Evidently this, that he has a right to make them give him a guarantee for the next ten years on payment of a premium of 11*l*. 12*s*. 3½*d*., which could not be done at so low a rate for a new comer. Compute the premium for a person entering at 40, and insuring 1000*l*. for 10 years; that is, divide 1000 times M(40)—M(50) by N(39)—N(49), and the answer will be found to be 13·800*l*., or 13*l*. 16*s*. If then any party aged 40, having been in the office ten years, were to put another person of the same age in his place at his own premium, he would obviously make that person a present of the difference between 11·6148*l*. and 13·800*l*., at once (since a premium is to be paid immediately), and for nine succeeding years, if the latter should live so long. And 13·800—11·6148 is 2·1852, while an annuity of 2·1852*l*. for nine years, at the age of 40, is worth N(40)—N(49) divided by D(40) and multiplied by 2·1852, or 15·903*l*. Add to this 2·185*l*. for the immediate difference, and we get 18·088*l*., differing only a halfpenny from 18·090*l*., the sum which the office has in reserve. If then the person who is to take the place of the insured at 40 years of age, were to pay him an equivalent, he must, besides taking on himself the future premiums, pay the retiring member 18·090*l*., which is therefore the value of the latter's policy. The last formula will always give the *accumulation* value of a policy, whether for the whole life or for a fixed term.

The preceding contains the most material calculations which are necessary in the management of an office, or rather, in forming an opinion on the management of an office. It is to be remembered that all which has hitherto been said supposes the rates of mortality and interest to be absolutely known and invariable, the parties to enter on their birthdays, and all claims to be adjusted at the terminations of whole years from the time of entry. We now proceed to the application.

An assurance company is a savings' bank, with a mutual understanding, presently to be noticed, between the contributors. To make out this proposition, let us suppose that A borrows money, and insures his life for the amount as a security to his creditor. For this he has to pay a premium. If life were certain, the office of the company would be to receive and invest these premiums, which would be calculated in such a manner as with their interest to amount to a sum sufficient to discharge the loan in a settled time. At the end of this time the creditor (who has been all this while receiving interest for his money from A) calls upon A to make his claim upon the office, and repay the loan with the money received. If such an office existed, life being certain, the rationale of the proceeding would be that the creditor, though tolerably confident of A's power and willingness to make any yearly payment, whether of interest or instalment, will not trust him steadily to lay by and improve yearly instalments, but requires that he should make his instalments payable to third parties, who are engaged not to return them on demand until they amount to a sum sufficient for the discharge of the debt. Such an office certainly could not exist, on account of the uncertainty of individual life. As soon however as it is known that the duration of masses of individuals can be calculated with tolerable accuracy, there is a remedy for the individual uncertainties. Let a large number of debtors, similarly situated with A, agree to be guarantees for one another; that is, let each of them pay during his life not only his own instalments, but such additional sums as will provide the means of meeting the deficits of those who die, and the savings' bank thus constructed will become an assurance-office. Of course it matters nothing whether these debtors pay their instalments to a person agreed on among themselves, or go to a company which undertakes the management of such concerns. And again, it makes no difference whether the instalments are for liquidation of debt, or to accumulate a provision for widows and children. We have taken the case of debtors, because in such a case an office looks more like a mere indemnity-office than when its contributors enter for the benefit of their families: still however, in the former case, it is evident that the premiums are partly instalments of debt, partly sums intended to make ood the deficiency of the life-instalments of those who ie.

Let us now suppose a company to be formed for the simple purpose of assuring lives. Their business is to invest the premiums of those who assure with them; their receipts will consist entirely of current premiums and interest on the investments of the old ones; and their outgoings will contain expenses of management, payment of claims, purchase of their own policies, and (possibly) losses by bad investment.

There is one question which is generally settled at the very outset, namely, whether the company is to be what is called mutual, proprietary, or mixed.

A mutual company is one in which the members stand bound to each other, and constitute the company themselves. In such a company no capital is, generally speaking, raised at the outset, except a small sum for necessary expenses at starting. This however is not necessarily the feature of a mutual company; for if its members choose to constitute themselves an investment company as well as an assurance company, they may, without losing their *mutual* character, require every assurer to be also a shareholder. In a mutual company the profits of course are divided among the assured.

A proprietary company is one in which a body of proprietors raise a capital and pledge it for the payment of claims, in case the premiums are not sufficient: for this security they receive, in addition to the interest of their own capital, the profits of the assurance business. It has long been proved that, with proper tables of premiums, and a fair amount of business at starting, this capital is an unnecessary security; and the only reason which could now make such an office desirable, would be the lowness of its premiums. Of course it matters nothing to the assured how they are paid, as long as they are paid; the capital may be diminished, but the assurer cares for nothing except its exhaustion before his turn comes. This must be the sole consideration with a person who is tempted by low premiums to a purely proprietary office: the nominal capital signifies nothing; it is upon the amount of assurance to which it (with the premiums) is pledged that the solvency of the office depends. Generally speaking however we believe it will be found that the purely proprietary offices have not allowed themselves to run much risk.

A mixed office is one in which there is a proprietary company, which does not take all the profits, but a share; the rest being divided among the assured. The only good effect of the capital upon the condition of the assured in such a company is this:—that the directors, having fixed capital as well as premiums, may justifiably seek for investments which a mutual company must avoid. Having the capital to make good purely commercial losses, they may perhaps attempt to get a higher rate of interest, and of course take more risk of loss; the assured, who are sharers in the whole of the profits, since the profits of premiums and profits of original capital are not distinguished, come in for their share of the extra profits of the capital. But no such attempt at gaining higher interest by secondary securities should be made until a sum sufficient (with future premiums) to meet all claims is invested in the very safest securities which the state of society offers.

There is much confusion in the ideas of many persons about interest, arising from not distinguishing between interest and other returns. The following remarks may serve to explain our meaning:—

Interest is the return which is made for the use of money, when the owner entirely relinquishes its management, and believes he has undoubted security for its return. 'Interest,' says Mr. M'Culloch, 'is nothing more than the net profit on capital.' The same author goes on to say, 'the rate of interest on each particular loan must of course vary according to the supposed solvency of the borrowers, or the degree of risk supposed to be incurred by the lender.' But here the acute writer from whom we quote, after setting out with the accurate definition of the political economist, proceeds to use the word in the common sense, in which it is no longer the net profit of capital. For this variation in the rate of interest (so called), this addition for possible insolvency, is or is meant to be only as much as will make every debtor who does pay contribute towards the bad debts of those who do not. Nothing then is netted by the in crease for suspicion of insolvency, in the long run, and one debt with another; so that, abiding by Mr. M'Culloch's definition of interest as the correct one, we should propose to call the additional sum debt insurance. To this we must add, that when a person employs his own money, as in trade or manufactures, he also gains that additional return which a borrower counts upon reserving to himself after paying the interest (and debt insurance, if any) to his creditor. This is neither interest nor debt-insurance, but is of the nature of salary, by which name it might be called. Perhaps it would be best to retain the term interest in its general loose signification, and to subdivide it, for accuracy, into pure interest or net profit, debt-insurance, and salary.

In the construction of a table of premiums, three points must be left to the judgment of the constructor, the rate of interest, the table of mortality, and the addition to be made for expenses of management and probable fluctuation, or discrepancy between the predictions of the table and the events which actually arrive. The third point would not arise if, as was once the case, the table of mortality made life much worse than the actually prevailing state of things shows it to be. Security against adverse fluctuation is thus taken in the choice of the table; and this was done by the older offices, which chose the Northampton Table;—by the Equitable, for instance. (Compare the mean duration of life in the Northampton Table with that of the Equitable experience, in MORTALITY.) But we hold decidedly by the method of choosing a true table, and augmenting the premiums given by it as a safeguard against fluctuation; and for this reason, that wrong tables are usually unequally wrong, making different errors at different ages, and thus augmenting different real premiums by different per-centages.

According to the Carlisle Table (which we prefer for the purpose), of 5642 persons alive at the age of 30, 3018 are alive at 65, whence the chance of living till the second age is 3018 ÷ 5642 or ·5525. Now by applying calculation to this question, we find that an office which would have practical certainty (thousands to one for it) that, as far as this instance is concerned, the office should not be injured by adverse departure of events from tables, must make provision for twenty-five deaths, at least, in the period abovementioned, more than the tables predict, out of 250 persons at the commencement. And this even on the supposition that the table itself can be certainly reckoned upon as representing the law of mortality of the whole insurable population. It would be a very long process indeed to apply calculation in detail, so as to form a well supported idea of the proper amount of precaution against fluctuation; and the question is mixed up with another, to which we proceed.

The rate of interest to be assumed is an element which requires the greatest caution. It must be a rate which can actually be made, and therefore prudence requires that it should be something below that which may reasonably be looked for. To show how powerful an agent it is, we shall repeat the example already given, of the 5642 insurers for twenty years, on the supposition that the office which charges as for 3 per cent. finds itself able to make 3½ per cent.

	£
(30) 5642 P	65530
y	2294
	67824
57 *c*	57000
	10824
(31) 5585 P	64869
	75693
y	2649
	78342
57 *c*	57000
+	21342
32) 5528 P	64207
	85549
y	2994
	88543

	£
Bt. over	88543
56 *c*	56000
+	32543
(33) 5472 P	63557
	96100
y	3364
	99464
55 *c*	55000
+	44464
(34) 5417 P	62917
	107381
y	3758
	111139
55 *c*	55000
+	56139

	£
Bt. over +	56139
(35) 5362 P	62279
	118418
y	4145
	122563
55 *c*	55000
+	67563
(36) 5307 P	61640
	129203
y	4522
	133725
56 *c*	56000
+	77725
(37) 5251 P	60989
	138714
y	4855
	143569
57 *c*	57000
+	86569
(38) 5194 P	60327
	146896
y	5141
	152037
58 *c*	58000
+	94037
(39) 5136 P	59654
	153691
y	5379
	159070
61 *c*	61000
+	98070
(40) 5075 P	58946
	157016
y	5496
	162512
66 *c*	66000
—	96512
(41) 5009 P	58179
	154691
y	5414
	160105
69 *c*	69000
—	91105
(42) 4940 P	57378
	148483
y	5197
	153680.

	£
Bt. over	153680
71 *c*	71000
—	82680
(43) 4869 P	56553
	139233
y	4873
	144106
71 *c*	71000
—	73106
(44) 4798 P	55729
	128835
y	4509
	133344
71 *c*	71000
—	62344
(45) 4727 P	54904
	117248
y	4104
	121352
70 *c*	70000
—	51352
(46) 4657 P	54090
	105442
y	3690
	109132
69 *c*	69000
—	40132
(47) 4588 P	53288
	93420
y	3270
	96690
67 *c*	67000
—	29690
(48) 4521 P	52510
	82200
y	2877
	85077
63 *c*	63000
	22077
(49) 4458 P	51779
	73856
y	2585
	76441
61 *c*	61000
	15441

It thus appears that the office leaves off with an accumulation of 15,441*l.* nearly; and if it be lucky during the first years, it may be said to be safe (as we find) against any fluctuation for which there is an even chance, by the increase of interest alone.

Take what amount of precaution we may, an office must, at first starting, depend upon something either of capital or guarantee. Even a mutual office must raise something at the outset. Tables must be constructed with very large additions to the calculated premiums, which are to meet the very earliest contingencies alone; indeed it is difficult to say what addition would be too large. But this point it is unnecessary to insist on, since we can hardly suppose it possible that any set of men would found an office with no resource except premiums from the very commencement. Supposing proper precautions to be taken, we imagine that an addition of 25 per cent. to premiums calculated from the Carlisle Tables at 3 per cent. per annum, is sufficient to place a mutual office upon a sound footing, and to give a very great prospect of a return in the shape of what is called profit. In never has been found that an office charging at this rate has been without surplus of some kind.

This surplus has been called by the inaccurate name of profit, whereas it is really that part of the security against fluctuation of interest and mortality which has been found to be unnecessary. In mutual offices it is to be returned to the assured in an equitable manner; in purely proprietary offices it is really profit to the proprietors, whose capital has yielded them the ordinary interest, since by hypothesis none of it has been necessary to meet claims, and they therefore share among themselves the residue of the premiums. It is impossible to avoid this surplus in a well-constituted office, for the mathematical line which separates surplus from deficiency cannot be expected to be attained, so that those who would not have the latter must take care to have the former. It is usual among the offices to adopt a plan for increasing this surplus, which we will now describe.

Two rates of premiums are adopted, the one less than the other. Those who pay the higher rate are to have a share of the surplus; those who pay the lower rate have nothing but the nominal sum for which they assure. If the table of lower rates yield a surplus (which it is supposed it will do), that surplus goes to augment the final receipts of those who assure for profits. This scheme may be very well practised by a proprietary company, or by an old mutual company, but whether it is a good plan for a young mutual company to adopt, may be a question.

The public has been much misled by a notion that assurance companies must accumulate large profits, and the Equitable has been constantly cited as the proof. Now all who would form an opinion on this subject must remember that the circumstances of the Equitable are very peculiar. It realized large accumulations, in the first instance, by an excess of caution, commendable at the time, but since proved to be unnecessary. Of late years, newly assured parties are allowed to share in these accumulations, on condition that they are first assured in the office for a large number of years, taking the chance of receiving less than their premiums are really worth. This however is not the question here; we merely stop to remind the reader who is disposed to form a general opinion about offices, because the executors of A, B, and C receive two or three times the sum for which those persons were nominally insured, that this only happens because D, E, and F, who died during the days of a caution which has since been shown to be unnecessary, did not get their share of the then existing surplus.

The expenses of management are relatively trifling when the office has obtained a large amount of business, but they bear heavily on young offices during the first years. The most formidable expense of all, at least to many, must be that of advertising; and this is a point on which it is well worth while to dwell.

When a tradesman advertises, he sacrifices, in the expense of the advertisement, a part of the profit which he would have had if his customers would have come without the advertisement. The only question for him is, whether it is better to turn his money more quickly with a smaller profit, or to wait longer and make a larger one; and that the first is found to be the best plan in many cases, the frequency of advertisements fully proves. It is purely a question for the tradesman to settle for himself, and the customer has no interest in the matter. But in the case of the assurance office, the matter is very different. If, in looking at a tradesman's advertisement, we should ask, *Who pays for this advertisement?* the answer would be easy; it is the tradesman himself, out of his own profits. But if we ask the same question with reference to the advertisement of an assurance company, the answer must be that it is paid out of the premiums of the assured. When the company is proprietary, the case is so far like that of the tradesman that it is paid out of surplus of premiums, which the assured will never get in any case; but when the company is one which is to return all or part of the profits to the assured, the latter may be certain that, *ceteris paribus*, his share will be larger the less the company advertises. There is a set-off certainly of this kind; the more business a company gets, the less heavily do the necessary charges of management bear upon the assured; so that, up to a certain point, advertising may be a beneficial outlay, since the necessary expenses of management, plus those of advertising, may be less when divided among the assured before the advertisement together with those who are brought by the advertisement, than the first of the former alone would be when divided among the first of the latter alone. But this must have a limit; for if not, the older offices would have continued their advertisements daily up to the present time: and even with regard to the proprietary company, which might perhaps consistently advertise a great deal more than the mutual company, there is yet this to be said, that a great quantity of advertising shows their premiums to be very profitable, for how else could they do it? and in such a company there is no return to the assured.

Again, when the advertisement is of this kind that it invites the public attention to lower rates of premiums than are charged elsewhere, and when such advertisement is very frequently repeated, the prudent assurer will naturally be disposed to ask how, if the premiums be so much reduced, this heavy expense of advertising is to be borne. When a tradesman advertises cheaper goods than his neighbours, we know that he relies upon making a very small profit upon his capital ten times in a year, instead of a larger profit two or three times. One per cent. is a small profit, but one per cent. per diem looks very like 313 per cent. per annum, excluding Sundays. But the assurance-office is of a very different kind of business: imagine a savings' bank advertising every day in the newspapers that it is a savings' bank, and will receive deposits; it is very clear that from and after the point at which the deposits so obtained relieve the necessary and constant charge of management, as above described, all advertisement is anything but beneficial to depositors. When therefore an assurer is induced by frequently repeated advertisements at last to deliberate upon going to an office, let him remember that this quantity of advertisement bodes him no good in itself, and let him look out as to whether there is any countervailing advantage: if he can find none, let him, for his own sake, take a little trouble to search-out an office which advertises less, and perhaps he will find it performs more. It is very easy to spend five thousand a year in advertising. Our limits will not allow us to speak of the *commission* (so called) which most offices give to those who bring them business. This practice has been frequently-attacked, and very feebly defended. All we say to those who assure is, insist upon having it for yourselves, and do not come worse off than your own agents would do, if you employed any. (On this point see the *Dublin Review* for August, 1840.)

The division of the profits (so called), that is, the method of returning to the assured the surplus of their premiums, with their accumulations of interest, has been the subject of much discussion. Offices have adopted very different modes of proceeding in this respect: some keep this surplus for the older members; some divide it by addition to the policies made annually, or at periods of five, seven, or ten years; some apply it in reduction of premiums as fast as its value is ascertained. Most, or all, of the methods followed by the offices seem to be fair, that is, they make the chance of surplus the same for one member as for another, at least of those who enter at the same age: if there be anything inequitable, it arises when the premiums are disproportioned at different ages, so that the surplus is differently levied upon different classes of members. Leaving this however, we shall proceed to inquire what may be the probable amount of surplus in an office charging premiums made from the Carlisle Table at 3 per cent., with 25 per cent. added, taking the most favourable suppositions. Let the mortality be no greater than that in the table, let there be no expenses of management, and let the office be able to net 4 per cent. compound interest. Then we find that the office is in reality charging for the following sums, under the name of 100*l.*; that is to say, all the preceding suppositions being correct, the office might undertake to pay the following sums instead of the 100*l.* minimum which they do really guarantee. The sums are only roughly put down, within a pound or thereabouts.

Age.	£.	Age.	£.	Age.	£.
20	166	35	157	50	148
25	163	40	155	55	144
30	160	45	152	60	141

There is an inequality here which arises from the supposition of the office gaining a greater interest than was supposed in its tables; and it is obvious that the young assurer must make that excess of interest more beneficial to the office than the old one. Consequently where an office realises some of its surplus by excess of interest, there is equity in giving the one who entered young somewhat more than the one who entered later in life. But this has never been the principle on which any office made its divisions: some distinguish those who have been a long time in the office from those who enter newly, and the greater number of those so distinguished must have entered younger than the greater number of the undistinguished; but the intention of the office has no reference to age at entry, but only to time of continuance.

The true method of determining the actually existing surplus must have some connection with that which would be followed if the company wished to break up, dividing its assets fairly among the assured. Let us suppose the stock of the company, all that it actually has or could realise, to be worth half a million, and that the premiums which the existing contributors would pay are valued at another half million, while the claims of these contributors are valued at 750,000*l.* Consequently there is a million to meet 750,000*l.* or 133⅓*l.* can be given for 100*l.* Now suppose that instead of breaking up, the office wishes to know how much it can afford to give in payment of a claim of 100*l.* The first question is, how did this surplus arise?—the office has in possession or prospect 250,000*l.* more than what is estimated to be absolutely necessary. If this surplus really arose out of the natural operation of the premiums, &c., it is clear that the office is now in a condition to pay 133⅓*l.* for 100*l.* Supposing this done for the current year, the valuation of the next year will point out what alteration, if any, is necessary. This mode of division is the safest in the long run, because any excess in one year will be compensated in future years. Another mode is to divide the surplus of 250,000*l.* among the existing policies, in equitable proportions; and a third is to consider it as advance of premium on the part of the existing contributors, and to diminish their future premiums as if they had actually made such advance. It is not however our present purpose to extend an article already longer than we had intended it to be, by entering into a lengthened explanation on this point.

We shall end by a table of the various assurance offices which are actually doing business in London, as complete as our means of knowledge enable us to make it: we cannot answer for its being perfectly complete. But, the present article being intended for the assurer, and not for the office, we make the following remark.

The benefits of life assurance (which is in reality a large combination of small sums for the purpose of beneficial investment, with a contract among those who invest that the inequalities of life shall be compensated so that those who do not live their average time shall be sharers in the good fortune of those who exceed it) and the moral considerations which should induce every friend of his species to promote and extend it, are of course not the particular motives which actuate the founders of such offices, though no doubt they have them in the same degree as others. To bring business to a particular office becomes their interest and their object; and every possible mode of investment has been held out to engage the attention and suit the particular objects of the assurer. To this of course, in general, we do not object: for instance, when a company proposes twenty different kinds of assurances, it is enough for the public that the terms of each kind are sufficiently high, and yet not too high. But it sometimes happens that among the proposals which are held out for the assurer's acceptance, are to be found some which altogether militate against the moral principles of assurance: these are prudence, foresight, and present self-denial for the attainment of ultimate prosperity and of present security against the chances of life. When an office announces that it is willing to leave a part of the premium in the assurer's hands, on his paying interest for it in advance, the office in the meanwhile holding the policy as a security,—what is it but enticing a person to assure for more than he can afford to do, and to borrow money for the purpose of paying the premiums? The office may, with caution, make itself secure; but it throws upon the customer the strong probability of future disappointment. When the time comes for thinking of the repayment of the advances which the office has virtually made, the assurer will frequently find himself obliged to sell that policy to the office which he had counted upon for the benefit of his family. Now out of the purchase money must be deducted the sums in arrear to the office (upon which interest has always been paid in advance); and when the assurer comes to put his balance against what he has actually paid, he will see that he never did a more imprudent act. The office is not to blame for anything but having thrown the original offer in his way; they have only lent him money on the same terms as they would have lent it to others; and they may say, and truly, that it was his own fault if he engaged in an imprudent speculation. But is it not then a fault to entice others to imprudence, knowing how much more easily men are induced to be imprudent than to be prudent?

Name of Office.	When instituted.	Nominal Capital subscribed.	Proportion of Profit given to the Assured.	Periods of Division.	Sum Assured is paid, after Proof of Death, within	Age.			Age.			Age.		
						20.			40.			60.		
		£				£	s.	d.	£	s.	d.	£	s.	d.
Active	1839	500,000			1 month	1	16	5	3	1	6	6	13	11
Albion	1805	1,000,000	none		30 days	1	15	9	3	2	3	6	7	3
Alfred	1839		four-fifths			2	3	7	3	7	11	6	7	4
Alliance	1824	5,000,000		5 years	3 months	1	16	11	3	6	6	7	14	11
Amicable	1706	none	all	annual	3 months	2	0	6	3	5	9	7	6	6
Argus	1834	300,000	none		3 months	1	11	2	2	13	9	6	6	6
Asylum	1824	240,000		5 years	6 months	1	11	9	2	17	1	6	10	9
Atlas	1808	1,200,000		7 years	3 months	2	3	7	3	7	11	6	7	4
Australasian, Colonial, and General	1839	200,000	one-half	5 years		1	10	3	2	15	3	6	3	9
Britannia	1837	1,000,000	none		1 month	1	12	5	2	15	1	6	9	1
British Empire	1838	500,000		5 years	3 months	1	16	11	3	4	7	6	15	11
British Colonial	1839	500,000	four-fifths	5 years	3 months	1	17	4	3	5	0	7	4	9
British Commercial	1820	1,000,000		7 years	3 months	2	3	7	3	7	11	6	14	11
Caledonian	1805	150,000	four-sixths	7 years	3 months	2	1	6	3	5	6	6	5	4
Church of England	1840	1,000,000	four fifths	7 years	3 months	1	17	4	3	3	6	7	7	6
City of Glasgow	1839	750,000	two-thirds		3 months	1	19	5	3	4	6	5	12	3
Clerical, Medical, and General	1825	500,000		5 years	3 months	2	0	6	3	3	8	6	7	2
Crown	1824	1,500,000	two-thirds	7 years	3 months	1	19	11	3	4	7	6	7	2
Eagle	1807	1,000,000	four-fifths	7 years	3 months	2	2	6	3	4	4	6	18	2
Economic	1823	200,000	three-fourths	5 years	6 months	1	14	7	2	19	9	7	0	7
Edinburgh	1823	500,000	four-fifths	5 years	3 months	1	17	4	3	3	2	6	15	8
English and Scottish Law	1839	1,000,000	two-thirds	7 years		1	19	6	3	6	6	7	4	6
Equitable	1762	none	two-thirds	10 years	3 and 6 months	2	3	7	3	7	11	6	7	4
European	1819	1,000,000	two-thirds	7 years	3 months	1	19	0	3	4	3	6	11	1
Family Endowment		500,000				1	17	9	3	5	9	6	7	11
Freemasons'						1	17	9	3	2	10			
General, Life, and Invalid	1839	500,000				1	13	6	2	19	2	7	2	3
Globe	1803	1,000,000	none		3 months	2	3	7	3	7	11	6	7	4
Guardian	1821	200,000		7 years	3 months	2	1	0	3	5	0	6	7	2
Hand in Hand	1836		one-fifth	6 years	3 months	2	3	7	3	7	11	6	7	4
Hope	1807	1,000,000	two-thirds	7 years	3 months	2	3	7	3	7	11	6	7	4
Imperial	1820	750,000	two-thirds	10 years	3 months	2	3	7	3	7	11	6	7	4
Law Life	1823	1,000,000	four-fifths	7 years	3 months	2	3	7	3	7	11	6	7	4
Legal and General	1836	1,000,000	four-fifths	at first 6, then 7 years	3 months	2	0	4	3	5	11	6	19	5
Licensed Victuallers'	1836	150,000												
London, Edinburgh, and Dublin	1840	500,000	two-thirds	5 years	3 months	1	17	4	3	5	0	7	4	8

Name of Office.	When instituted.	Nominal Capital subscribed.	Proportion of Profit given to the Assured.	Periods of Division.	Sum Assured is paid, after Proof of Death, within	Age. 20.	Age. 40.	Age. 60.
		£				£ s. d.	£ s. d.	£ s. d.
London Life	1806	none	one-fifth	annual	3 months		3 15 0	7 8 0
London and Westminster	1839	500,000		5 years		1 19 1	3 6 3	6 12 6
Metropolitan	1835	none	all	5 years	3 months	1 19 6	3 6 4	6 11 6
Minerva	1836	1,000,000	four-fifths	5 years	3 months	2 1 0	3 5 0	6 7 2
Mutual	1834	none	all	annual	3 months	1 19 11	3 7 6	7 2 0
National	1830	500,000	two-thirds of one-fifth	annual	3 months	2 3 6	3 8 0	6 7 6
National Endowment	1838	500,000			30 days	1 16 3	3 2 0	6 5 6
National Loan Fund	1837	500,000	two-thirds	after 3 years, annual		1 17 4	3 5 3	7 8 4
National Provident	1835							
North British	1809	1,000,000	two-thirds	7 years	3 months	2 1 0	3 4 11	6 7 2
North of Scotland	1839	1,000,000			3 months	1 18 10	2 19 5	6 12 9
New Equitable	1840	800,000			3 months	1 16 10	3 3 5	6 6 6
Norwich Union	1808	none		7 years	3 months	2 0 6	3 3 6	6 7 3
Palladium	1824	200,000	four fifths	7 years	3 months	2 3 7	3 7 11	6 7 4
Pelican	1797		one-half	7 years	3 months	1 16 1	3 2 8	7 11 7
Productive	1840		all	annual	2 months	2 2 2	3 7 11	6 14 4
Promoter	1826	240,000	none		6 months	1 11 8	2 17 0	6 12 10
Protector	1835	1,000,000	three-fourths	5 years	3 months	2 1 0	3 5 0	6 7 2
Protestant Dissenters'		1,000,000			3 months	2 0 0	3 7 0	7 0 0
Provident	1806	250,000		7 years	3 months	2 3 7	3 7 11	6 7 4
Rock	1806	2,000,000	two-thirds	7 years	8 months	2 3 7	3 7 11	6 7 4
Royal Exchange	1722	745,000	none		on proof	2 3 6	3 8 0	6 7 3
Royal Naval, Military, and East India	1837	500,000	four-fifths	7 years	3 months	2 3 2	3 7 8	7 0 4
Scottish Union	1824	5,000,000	two thirds		3 months	1 18 5	3 5 0	6 7 10
Scottish Widows' Fund	1815	none	two thirds	7 years	3 months	2 1 6	3 5 6	6 5 4
Sun	1810		one-half	7 years	3 months	1 16 11	3 6 6	7 14 11
Union	1714	300,000	one third	7 years	3 months	2 3 7	3 7 11	6 7 4
United Kingdom		1,000,000	two-thirds	5 to 7 years	3 months	1 18 8	3 3 4	6 17 9
United Mercantile and Travellers'							3 4 11	7 4 9
Universal	1834	500,000	three-fourths	after 5 years, annual	3 months	1 18 8	3 3 0	6 13 2
University	1825	600,000	four fifths	5 years	3 months	2 1 5	3 4 7	6 7 4
Victoria	1838	500,000				1 16 11	3 6 6	6 19 0
West of England	1807	600,000		5 years	3 months	1 19 3	3 1 3	6 5 0
Westminster	1792		5 per cent. at the end of 5 yrs.	1 per cent. ann.		2 3 7	3 7 11	6 7 4
Westminster and General			four-fifths	5 years	3 months	2 1 8	3 4 6	6 7 4
Yorkshire	1824	500,000			3 months	1 14 4	2 19 9	6 6 0

REVERSION OF SERIES. In the nomenclature of mathematics, which is far from being consistent with itself, the words *reversion* and *inversion* are sometimes confounded. Thus the term by which we describe the square root, as connected with the square, is, that each is an INVERSE process to the other; but if y be a given series of powers of x, the determination of x in a series of functions of y is not called inversion, but reversion. Various points connected with reversion (to keep the common term) will be met with in TAYLOR'S THEOREM and SERIES; the present article is meant purely for reference upon the most usual case of the problem, which is not sufficiently developed in elementary works; that is, enough of the result for reference is not put down.

The problem is as follows:—Given $y=ax+bx^2+cx^3+ex^4+fx^5+\ldots$; required x in a series of the form $Ay-By^2+Cy^3-Ey^4+\ldots$. It will be proper first to put down the coefficients in connection with the exponents to which they belong, as follows:—

1	2	3	4	5	6	7	8	9	10	11
a	b	c	e	f	g	h	k	l	m	n
A	B	C	E	F	G	H	K	L	M	N

It will be convenient, instead of writing the resulting series $Ay-By^2+\ldots\ldots$, to let it be $Aa^{-1}y-Ba^{-3}y^2+Ca^{-5}y^3-Ea^{-7}y^4+Fa^{-9}y^5-Ga^{-11}y^6+Ha^{-13}y^7-Ka^{-15}y^8+La^{-17}y^9-Ma^{-19}y^{10}+Na^{-21}y^{11}-\ldots\ldots$ We then have

$A=1$

$B=b$

$C=2b^2-ac$

$E=5b^3-5abc+a^2e$

$F=14b^4-21ab^2c+3a^2(2be+c^2)-a^3f$

$G=42b^5-84ab^3c+28a^2(b^2e+bc^2)-7a^3(bf+ce)+a^4g$

$H=132b^6-330ab^4c+60a^2(2b^3e+3b^2c^2)-12a^3(3b^2f+6bce+c^3)+4a^4(2bg+2cf+e^2)-a^5h$

$K=429b^7-1287ab^5c+495a^2(b^4e+2b^3c^2)-165a^3(b^3f+3b^2ce+bc^3)+45a^4(b^2g+2bcf+be^2+c^2e)-9a^5(bh+cg+ef)+a^6k$

$L=1430b^8-5005ab^6c+1001a^2(2b^5e+5b^4c^2)-715a^3(b^4f+4b^3ce+2b^2c^3)+55a^4(4b^3g+12b^2cf+6b^2e^2+12bc^2e+c^4)-55a^5(b^2h+2bcg+2bef+c^2f+ce^2)+5a^6(2bk+2ch+2eg+f^2)-a^7l$

$M=4862b^9-19448ab^7c+8008a^2(b^6e+3b^5c^2)-1001a^3(3b^5f+15b^4ce+10b^3c^3)+1001a^4(b^4g+4b^3cf+2b^3e^2+6b^2c^2e+bc^4)-286a^5(b^3h+3b^2cg+3b^2ef+3bc^2f+3bce^2+c^3e)+22a^6(3b^2k+6bch+6beg+3c^2g+3bf^2+6cef+e^3)-11a^7(bl+ck+eh+fg)+a^8m$

$N=16796b^{10}-75582ab^8c+15912a^2(2b^7e+7b^6c^2)-12376a^3(b^6f+6b^5ce+5b^4c^3)+2184a^4(2b^5g+10b^4cf+5b^4e^2+20b^3c^2e+5b^2c^4)-273a^5(5b^4h+20b^3cg+20b^3ef+30b^2c^2f+30b^2ce^2+20bc^3e+c^5)+182a^6(2b^3k+6b^2ch+6b^2eg+6bc^2g+3b^2f^2+12bcef+2c^3f+2be^3+3c^2e^2)-78a^7(b^2l+2bck+2beh+c^2h+2bfg+2ceg+cf^2+e^2f)+6a^8(2bm+2cl+2ek+2fh+g^2)-a^9n$

We have given these coefficients to an extent which many will think useless, and in fact it will not often be necessary to employ all that are here given. But we have two objects in view: first, to enable those who want these coefficients to refer to them; secondly, to point out the great advantage of some methods which are never given in elementary works, and are not so much known and practised as methods of such utility and power should be.

The usual way of obtaining these results is to take the series $x=Aa^{-1}y-Ba^{-3}y^2+\ldots\ldots$, and in it to substitute the value of y, namely, $ax+bx^2+\ldots$. This would give

$$x=\frac{A}{a}(ax+bx^2+\ldots)-\frac{B}{a^3}(ax+bx^2+\ldots)^2+\ldots,$$

the two sides of which equation must be identical; giving

$$A=1,\quad A\frac{b}{a}-B\frac{1}{a}=0,\quad \text{or } B=b;$$

$$\frac{A}{a}c-\frac{2B}{a^2}b+\frac{C}{a^2}=0,\quad \text{or } C=2b^2-ac,$$

and so on; but this process would become intolerably tedious and liable to error after a few steps; that which we have followed in forming the preceding coefficients [TAYLOR'S THEOREM] would have enabled us with comparatively little difficulty and small risk of error to double their number. It also gives the law of the coefficients, which is as follows:—

1. What sort of terms enter into M, the coefficient of y^{10}? Write down every way in which $2(10-1)$, or 18, can be made up of $10-1$, or 9, numbers, and, taking the letters

belonging to these numbers from the table, we have the literal parts of the different terms of the coefficients. Thus—

18 is made up of the nine numbers 1, 1, 1, 1, 2, 2, 2, 2, 6, the letters of which are $a, a, a, a, b, b, b, b, g$: accordingly, $a^4 b^4 g$ is the literal part of one of the terms of M. And similarly for every other combination of nine numbers which makes 18.

2. What is the coefficient of any given term? Say that y^n is the power to which the term belongs, and that $a^\alpha b^\beta c^\gamma \ldots$ is the literal part of it. The coefficient required is as follows:—

$$\frac{(n+1)\ (n+2)\ldots\ldots(2n-\alpha-2)}{(1.2.3\ldots.\beta)\ (1.2.3\ldots.\gamma)\ (1.2.3\ldots.\delta)\ldots.}$$

Thus, to verify the numerical coefficient of $a^6c^2e^2$ in N, the coefficient of y^{11}, we must calculate ($n=11$, $\alpha=6$, $2n-\alpha-2=14$),

$$\frac{12\ .\ 13\ .\ 14}{(1.2)\ (1.2)},\ \text{which is } 6.13.7, \text{ or } 546,$$

and 182×3, the coefficient in the table, is also 546.

2. The sign of any term is positive or negative according as the power of a which it contains is even or odd.

We may thus verify any one term, and the coefficients may be sufficiently verified, as to typographical* correctness, by remembering, that if $a=b=c=\&c.=1$, we should have $A=B=C=\&c.=1$; for $y=x+x^2+x^3+\ldots$ gives $x=y-y^2+y^3-\ldots.$ The result of the use of the preceding table, distinguishing the positive from the negative parts, is

$$\begin{aligned}x=y-y^2+(2-1)y^3-(6-5)y^4+(23-22)y^5-(99-98)y^6\\ +(452-451)y^7-(2140-2139)y^8+(10397-10396)y^9\\ -(51525-51524)y^{10}+(259430-259429)y^{11}.\end{aligned}$$

The preceding is a particular case of the following general problem, which frequently occurs, and is very complicated in its details. Given $y^m=ax^m+bx^{m+1}+cx^{m+2}+ex^{m+3}+fx^{m+4}+\ldots.$; required a series for x in powers of y. Let it be assumed that

$$x=$$

$$A\frac{y}{a^n}-B\frac{y^2}{a^{2n+1}}+C\frac{y^3}{a^{3n+2}}-E\frac{y^4}{a^{4n+3}}+F\frac{y^5}{a^{5n+4}}-\ldots..$$

n being $1:m$. Then $A=1$, $B=nb$:

$$C=n\frac{3n+1}{2}b^2-n\,ac$$

$$E=n\frac{4n+1}{2}\frac{4n+2}{3}b^3-n\frac{4n+1}{2}\,2abc+n\,a^2e$$

$$F=n\frac{5n+1}{2}\ \frac{5n+2}{3}\ \frac{5n+3}{4}b^4-n\frac{5n+1}{2}\ \frac{5n+2}{3}\,3ab^2c$$

$$+n\frac{5n+1}{2}a^2(2be+c^2)-n\,a^3f$$

Methods of obtaining all these series are given in TAYLOR'S THEOREM.

REVERSION. 'Reversion of land is a certain estate remaining in the lessor or donor, after the particular estate and possession conveyed to another by lease for life, for years, or gift in tail. And it is called a reversion in respect of the possession separated from it; so that he that hath the one, hath not the other at the same time, for being in one body together, there cannot be said a reversion, because by the uniting, the one of them is drowned in the other. And so the reversion of land is the land itself when it falleth.' (*Termes de la Ley.*) Thus if a man seised in fee simple conveys lands to A for life, or in tail, he retains the reversion in fee simple. The distinction between a remainder and a reversion has been explained in REMAINDER. In all cases where the owner of land or the person who has an estate in land, grants part only of his estate, he has a reversion; and as the grantee holds of him, there is tenure between them, and the grantor has a seignory by virtue of having a reversion. When a man grants all his estate to another, or grants a particular estate to A, and various remainders over, remainder to F in fee, he has no reversion left, and therefore he has no seignory since the passing of the statute of Quia Emptores. The remainder-men also who precede the remainder-man in fee, do not hold of such remainder-man, but of the lord of the fee of whom the original owner held. The word reversion is often used inaccurately, and it is sometimes necessary to recur to its strict legal signification.

Before the passing of the statute De Donis, if a man seised in fee simple granted his lands to a man and the heirs of his body, he had no reversion, for the grantee was considered to have a conditional fee. But since this statute, an estate to a man and the heirs of his body has always been considered to be a particular estate.

If a man grants a lease of lands in possession, at common law, he has no reversion until the lessee enters by virtue of his lease, for the lessee has no estate until he enters; but if the term of years is created under the Statute of Uses, as by bargain and sale, the lessee has a vested estate by virtue of the statute, without entering on the land, and consequently the lessor has a reversion. It is said that a reversion cannot be created by deed or other assurance, but arises from construction of law. This means that a reversion is not created by the act of the party who conveys part of his estate, but is a legal consequence of his acts. If a man seised in fee simple limits his estate to another for life or in tail, remainder to himself in fee or to his own right heirs, he has not a remainder, but a reversion. Yet by a recent statute (3 and 4 Wm. IV., c. 106) the effect of such a limitation is to vest such remainder in fee in the settlor by *purchase*, and he is not to be considered to be entitled to it as his former estate or part thereof.

A reversion is a vested estate, which may be granted or conveyed, and charged like an estate in possession; and in some cases the reversioner in fee may bring an action, as well as the tenant in possession, for an injury to his inheritance.

Fealty is an inseparable incident to a reversion. There may or may not be a rent reserved, but fealty is always due from the owner of the particular estate to the reversioner, and it cannot be separated from the reversion, though the rent, if there is one reserved, may be separated from it. [RENT.] Reversions which are expectant on estates for years are subject to dower and courtesy; but this is not the case with reversions expectant on a freehold estate.

By a recent act (3 and 4 Wm. IV., c. 104), reversionary estates or interests in lands, tenements, and hereditaments, corporeal and incorporeal, are assets to be administered in courts of equity for the payment of a person's debts both on simple contract and on specialty, when such person shall not by his last will have charged such estates or interests with or devised them subject to the payment of his debts.

When a reversion expectant on an estate tail comes into possession, it is liable to the leases made by those who were at any time entitled to the reversion, and to the covenants contained in such leases. All particular estates, except an estate tail, are subject to merge in the reversion, when the particular estate and the reversion are united in the same person. Formerly when an estate tail was converted into a base fee, and the remainder or reversion in fee in the same lands became united in the same person, the base fee was subject to merger in the reversion: but by the 39th section of 3 and 4 Wm. IV., c. 74, when such union takes place, and there shall be no intermediate estate between the base fee and the remainder or reversion, 'the base fee shall not merge, but shall be *ipso facto* enlarged into as large an estate as the tenant in tail, with the consent of the protector, if any, might have created by any disposition under this act, if such remainder or reversion had been vested in any other person.' Before this statute, when a base fee thus merged in the reversion, the reversion became an estate in possession, and liable to all the leases and charges of those who had at any time been entitled to it.

REVETMENT, in permanent fortification, is a wall of brick or stone retaining the mass of earth which constitutes the rampart, generally on the exterior side only, or retaining the earth which forms the opposite side of the ditch. The exterior faces of these walls are considered as the scarp and counterscarp of the ditch.

In and before the time of Vauban the scarp revetments were raised from the bottom of the ditch to the top of the parapet; but the part which was visible above the glacis being destroyed by the enemy's artillery, and the parapet in consequence partly ruined soon after the commencement of the siege, that engineer in most of his works raised his revetments no higher than the level of the crest of the glacis, or about 7 feet above the natural ground; the exterior of the parapet was then left at such an inclination to the horizon (45° in general) that the earth would support itself. The ditch of a fortress being about 18 feet deep, the height of the scarp revetment was consequently 25 feet, and this was considered sufficient to afford security against the danger of having the rampart escaladed. At present it is recommended that the main ditch should be 24 feet deep, and in this case the scarp revetment is above 30 feet high. In constructing the fortifications of Neuf Brisac, Vauban made the revetments of the scarps both of the enceinte and of the reduit of the ravelin, as high as the top of the parapet; but these works being covered by the counterguard or the ravelin, their revetments would be unseen by the enemy at a distance, and therefore not liable to the objection above mentioned.

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* Should there be any error, it will be mentioned in SERIES.

The form usually given in profile to revetments of masonry may be seen at M and N, *fig.* 2, Bastion; the first is the revetment of the counterscarp, and the other that of the scarp. The rectangular parts are sections through the counterforts or buttresses which are built up with the walls in order to strengthen them, at intervals of about 15 feet from each other. Scarp revetments, whose tops are as high or higher than the crest of the glacis, are called full revetments; while such as are no higher than the level of the natural ground are called demi-revetments.

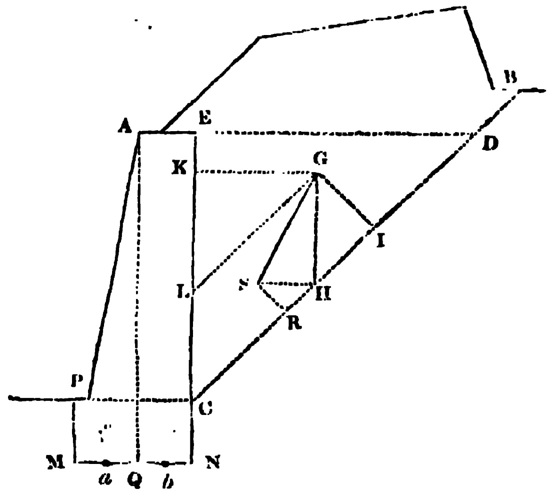
In order that the revetment might most effectually resist the pressure of the earth which it is to support, Vauban gave to the exterior face of the wall a slope, whose horizontal breadth was equal to one-fifth of the height; this was subsequently reduced to one-sixth, and not long since there were thought to be some advantages in making the face vertical.

In laying the foundations of revetments in defective soils, the same methods are used as in the construction of civil edifices; and in all cases the courses of stones or bricks are laid obliquely to the horizon, inclining down towards the part under the earth which is to be supported, in order that the pressure of the latter may be more directly resisted. But as the bed-joints of brickwork when so disposed allow the rain to penetrate, and the seeds of grass to lodge in them, it is thought that the wall is more speedily degraded when so built than when the courses are laid horizontally; therefore in order to unite the advantages of direct resistance and durability, it is customary to place the courses obliquely, but to lay one row of bricks in each course at the face of the wall in a horizontal position.

The exterior and interior faces of the revetment, or retaining wall of a dock, have in a vertical section the form of concentric arcs of circles, with their convexities towards the land; and this form is given them that the stones may be able to resist the hydrostatical pressure of any water which, when the dock is full, may get behind the wall, and which may be prevented from escaping when the dock is made dry.

Some of the ramparts of Coehorn, and all of those which Carnot proposed for his fortresses, are formed of earth unsupported by revetments; and even the opposite side of the ditch, instead of being faced with a steep wall, is by the latter engineer cut with a gentle slope from the level of the natural ground to the bottom of the ditch. But the fortifications of Coehorn are provided with wet ditches, which prevent the besiegers from getting to the foot of the rampart by surprise; and in those of Carnot a high detached wall covered by a counterguard of earth puts it out of the power of the enemy, while that wall stands, to get across the ditch. Without such obstacles the unreveted rampart would afford great facilities to the enemy in an effort to carry the fortress by assault. Its exterior slope must form at most an angle of 45° with the horizon, that the earth may support itself, and consequently it may be easily ascended; and any palisades or other impediments which the defenders might place on it would soon be displaced or destroyed by the batteries of the enemy. Besides these evils, the exterior slope, from its breadth, occupies a great portion of ground; it consequently obliges the engineer to contract the space enclosed within the works, and thus to sacrifice in some measure the convenience both of the inhabitants and the garrison.

In order to investigate the conditions of stability in revetment walls, let EBC be a vertical section through the mass of earth retained by the wall; BC being the slope which earth is supposed to assume when unsupported, and let AEMN be a section of the wall, PC being the level of the bottom of the ditch, and MN being the bottom of the foundation. Imagine G to be the centre of gravity of the section ECB; draw GL parallel to BC and GK parallel to the horizon: then, by the resolution of forces, KL and GK will have to one another the same proportion that the weight of the unsupported prism of earth (of any thickness) bears to its horizontal pressure. Let W be that weight; then $\frac{\mathrm{KG}}{\mathrm{KL}}$ will express that pressure, and $\frac{\mathrm{KG}}{\mathrm{KL}} . \mathrm{W} . \mathrm{KN}$ will be the momentum or power by which the earth tends to overturn the wall about M.



Imagine the vertical line AQ to be drawn; then the form and dimensions of the part AMQ of the wall are known. and let it be required to find the breadth QN of the rectangular part AN, so that the resistance of the whole shall be equal to the momentum of the supported earth. Suppose the centre of gravity of AMQ to be found, and let it be vertically over *a*. The centre of gravity of the rectangular part is vertically over *b*, the middle of QN; and let Q*b* be represented by *x*. Then if *g* be the specific gravity of the wall, we have by mechanics, $\mathrm{AMQ} \cdot \mathrm{M}a \, . \, g + \mathrm{AQ} \, . \, \mathrm{M}b \, . \, g \, . \, x$ for the resistance of the wall; consequently equating this expression with the above momentum of the earth, the value of *x*, and therefore of QN, can be found. But great uncertainty exists respecting the position of the line of rupture BC, from our ignorance of the allowance to be made for the effect of friction on the tendency of the earth to slide downwards. Experiments have led to the opinion that this effect is equal to half the pressure of the earth perpendicularly upon the inclined plane which it would assume if unsupported; and that value is frequently adopted.

In order to find the magnitude which the triangle EDC should have when the supported earth exerts the greatest pressure against the wall, the following process may be used; the earth above AD being at present, for simplicity, supposed to be removed. Imagine G to be the centre of gravity of that triangle, and the vertical line GH to be drawn; then GH may represent the weight of the unsupported earth, and let it be resolved into the pressures represented by GI and IH, the former perpendicular to the slope, and the latter coincident with it. Imagine HS to be drawn to represent the re-action of the wall AMN, and let it be resolved into the forces represented by SR and RH, perpendicular to and coincident with the slope, respectively. Then, IH representing the force with which the prism of earth would tend, if without friction, to slide down DC, RH represents the re-action by which the wall resists that force; while GI and SR represent the pressure and reaction perpendicular to DC. Consequently, the friction being supposed to be equal to half the pressure, we have $\frac{1}{2}(\mathrm{GI}+\mathrm{SR})$ for the effect of friction; and in the case of equilibrium, $\mathrm{IH}=\mathrm{RH}+\frac{1}{2}(\mathrm{GI}+\mathrm{SR})$.

Let $\mathrm{EC}=h$, $\mathrm{ED}=z$, $\mathrm{HS}=p$, and let *g* be the specific gravity of the earth; then $\frac{hgz}{2}$ expresses the weight of the prism whose section is EDC, and whose thickness is unity, and which was represented by GH; and the triangles GIH, HSR being similar to ECD, we get by proportions

$$\mathrm{IH} = \frac{h^2gz}{2\mathrm{CD}}, \ \mathrm{HR} = \frac{pz}{\mathrm{CD}}, \ \mathrm{GI} = \frac{hgz^2}{2\mathrm{CD}}, \text{ and } \mathrm{SR} = \frac{ph}{\mathrm{CD}}.$$

These values being substituted in the above equation, the value of the pressure HS or p will be found to be $\frac{h}{2} g \cdot \frac{2hz-z^2}{2z+h}$. Now this quantity is to be a maximum; therefore making its differential relatively to z equal to zero, the value of z will be found to be $\cdot 618h$; whence $p = \cdot 1908 g.h^2$. If this equation be differentiated relatively to h, the result will express the horizontal pressure against an elementary portion of the wall at a variable height (which represent by h) above C: therefore multiplying by h and integrating, we get $\cdot 1272 gh^3$ for the whole force exerted by the earth to overturn about M a wall whose height EC is represented by h, when that force is a maximum. When there is a parapet above AD, its weight, expressed by the product of the area of the section multiplied by g must be added to the above expression for the weight of the prism EDC in the preceding investigation, in order to obtain the value of the expression which is represented by GH.

Instead of making a revetment in the form of a simple wall, it is customary to build buttresses or counterforts at intervals from each other on the side next to the supported earth; consequently the thickness of the wall itself may be rather less than that which would result from the above equation. In order to determine it, if we assume, for example, that the distance from the centre of one counterfort to that of the next is fifteen feet, the area of a horizontal section fifteen feet long and taken at the mean height of the wall, if the face has a slope, together with the area of the like section through the two half-counterforts, may be equal to the area of a section of the simple wall (of the same length) as determined by the above investigation; then deducting one-fifth of that quantity for the two half-counterforts, the remainder divided by 15 will give the required breadth of a horizontal section at the part between the counterforts. It should be observed however that the thickness of a brick revetment which is to resist the fire of a battering-train should not be less than seven or eight feet. It is usual to make the depth of a counterfort equal to the mean breadth of the wall; and to give it greater thickness at the part which joins the wall than at the other extremity.

Counterforts serve in part as props to keep the wall from inclining in consequence of partial compressions in the cement; but chiefly by extending the breadth of the base at intervals they increase, at the places where they are formed, the length of the arm of the lever by which the weight of the wall resists the lateral pressure of the earth. The usual connection of the bricks or stones in the wall with those of the counterforts allows this advantage to be extended in nearly an equal degree to the parts which are situated between the counterforts. But in order that the connection may be more complete, it has been recommended to connect the tails of every two counterforts by a wall curved on the plan, and having the convex side towards the earth which is to be retained. Again, the nearest sides of every two counterforts have occasionally been connected by two or more arches, one above another; by which means the mass of retained earth is in part supported, and the lateral pressure of the whole is diminished.

Revetments in which the counterforts are connected in either of those ways are said to be counter-arched; and it is recommended that arches of the latter kind should be formed in the mass of the parapet above the cordon of the scarp. It is also recommended that the masonry of the arches in the rampart should be but slightly connected with that of the revetment wall; since then the greater part of the rampart and parapet will remain supported by the arches even after the revetment has been demolished by the artillery of the besiegers.

REVOLUTION. This well known term is applied in astronomy to the manner in which a detached body moves round another, as a planet round the sun; but the motion of connected particles of matter round an axis, such as the diurnal revolution of a planet, is more usually called ROTATION.

In pure mathematics the word revolution is applied to the angle moved over by a line which revolves round a point from any one position to that position again; it is therefore a synonym for four right angles.

REVOLUTION OF 1688. [WILLIAM III.]

REY, JEAN, a French physician, was a native of Bugue on the Dordogne. In 1630 he published, at Bazas, a town about 30 miles south-east of Bordeaux, a book under the following title: 'Essays de Jean Rey, Docteur en Médécine, sur la Recherche de la Cause pour laquelle l'Estain et le Plomb augmentent de poids quand on les calcine.' To this inquiry it appears that Rey was incited by a letter from Sieur Brun, prefixed to the work, as the cause 'qui a donné sujet au présent discours.' M. Brun states that on subjecting melted tin to the air in a pot, he found that it increased very considerably in weight, and applied to Rey to explain so unexpected a fact, and he afterwards made a similar experiment with lead, and with a corresponding result.

Rey, after refuting all the different explanations of this increase of weight which had been advanced, says, in his 16th essay, 'I have now made the preparation, laid as it were the foundation of my answer to the Sieur Brun's demand, namely, that having put *two pounds six ounces* of fine English tin into an iron vessel, and heated it strongly in open air for six hours, stirring it continually, without having added anything, he obtained *two pounds thirteen ounces* of a white calx, which at first occasioned him great surprise, and the desire to ascertain whence these seven ounces of increase were derived; now, to augment the difficulty, I say that we must not only inquire whence these seven ounces are derived, but moreover, whence that which has replaced the loss of weight necessarily arising from the enlargement of the volume of the tin by its conversion into calx, and from the vapours and exhalations that have evaporated. To this question then, resting on the foundations that I have laid, I answer, and proudly maintain, that this increase of weight comes from the air, thickened and made heavy, and in some measure rendered adhesive on the vessel, by the violent and long-continued heat of the furnace, which air mixes with the calx (its union being assisted by the continual stirring), and attaches itself to its smallest particles, no otherwise than as water when sand is thrown into it makes it heavier by moistening it and adhering to its smallest grains.'

In the 11th and subsequent volumes of the Royal Institution Journal, Mr. Children has given translations of various essays of Rey, which are extremely well worth perusal by those who are curious in the history of chemical discovery. We have already mentioned that Rey's work first appeared in 1630, and it was greatly neglected till 1777, when a new edition appeared, and it is remarked by Mr. Children that the 'copies of this reprint disappeared in a very sudden and remarkable manner,' and the fact has led to a suspicion that it was effected by Lavoisier and his friends, to avoid the imputation of plagiarism in his celebrated work which appeared about three years afterwards.

Mr. Children and Dr. Thomson however are both inclined to give full credit to the assertion made by Lavoisier that he knew nothing of Rey's Essays when he originally undertook his experiments.

REYNOLDS, SIR JOSHUA, born at Plympton, July 16, 1723, of an antient family of the county of Devon, was the son of the Rev. Samuel Reynolds, rector of Plympton St. Mary, and master of the free grammar-school there. This celebrated painter was originally intended by his father for the medical profession, but he manifested when still a child so great a taste for drawing, that his father was induced to abandon his intention. Reynolds's natural inclination to the arts was much strengthened by studying the Jesuits' Perspective, but was finally confirmed, and became a passion, through the perusal of Richardson's treatise on painting, and he was from that time resolved to become a painter. He was accordingly, in 1741, in his eighteenth year, placed by his father for four years with Hudson, the principal portrait-painter of that time. The plan of instruction adopted by this painter, that of setting his pupil to copy Guercino's drawings, had a decided influence upon Reynolds's future taste, and was unquestionably one of the principal causes of the difficulty which he ever after experienced when drawing from the life, and especially from the naked figure. Reynolds and his master did not agree, and they separated in an unfriendly manner when half the period of the engagement had expired. Reynolds returned into Devonshire, and upon this slight foundation commenced his career as a portrait-painter, at Plymouth Dock. He was fortunate in obtaining the patronage of Lord Mount Edgecombe, whose influence was of the utmost service to him in procuring him introductions to the most distinguished naval officers of that port, amongst whom was Captain (afterwards Admiral Lord) Keppel, a connection that proved subsequently most valuable to him. Many naval and military officers sat to him for their portraits at this time; and he exhibited at this early stage of his career decided traces of his future style. The portraits of William Gandy of Exeter, which he greatly admired for their bold and effective manner, tended not a little to confirm that taste which his previous education from Guercino was so well calculated to engender. After the death of his father, in 1746, Reynolds came to London, where he took apartments and commenced practice in St. Martin's Lane, then a favourite quarter with painters. In 1749 he accompanied Commodore Keppel as that officer's guest, in the Centurion, to the Mediterranean; and after a delay of two months at Minorca, where he resided with the governor, General Blakeney, and during which time he painted the portraits of several naval and military officers, he embarked for Leghorn, and prosecuted his journey to Rome.

Perhaps, with the exception of Flaxman, no English artist of eminence ever took so much experience with him to Rome as Reynolds did; yet, when he first saw the grand works of Raphael in the Vatican, he was greatly disappointed. However, as he himself has recorded, he did not for a moment suppose that Raphael owed his reputation to the ignorance or caprice of mankind, but he felt his own ignorance, and stood abashed. All the undigested notions of excellence which he had brought with him from England were to be eradicated from his mind; he felt that he had originally formed a false opinion of the perfection of art; 'and that if those works had really been what he expected, they would have contained beauties superficial and alluring, but by no means such as would have entitled them to the great reputation which they have so long and so justly obtained.'

Notwithstanding this candid confession, the conviction seems to have had little or no influence upon his own manner in after-life, for he never possessed one single quality in common with Raphael.

Reynolds never made a practice of copying pictures or taking sketches of whole compositions, as is the habit with many young painters. He very properly considered copying a 'delusive kind of industry;' yet he was in the habit of selecting parts of compositions which were of striking excellence, or from an attentive study of which he imagined he should derive substantial benefit. It was in studying the various great works in the Vatican, particularly those of Michael Angelo and Raphael, that he contracted a severe cold which caused a deafness for the remainder of his life. From Rome he went to Florence, Bologna, Parma, Modena, Milan, Padua, and Venice, where he lodged with Zuccarelli, the landscape painter. The great masters of Venice, Titian, Paul Veronese, and Tintoretto, had a far greater influence upon Reynolds's future practice than the great works in Rome. The rich effect of Venetian tone and colour were much more suited to his genius or taste, which decidedly inclined to the florid or ornamental; and however much his better judgment may have induced him to extol the grandeur of the Roman school in his discourses, it was the magnificence of the Venetian that captivated him, that guided his practice, that excited his emulation. From Venice he went through Turin to Paris, where he made a short stay, and returned to Plymouth towards the end of the year 1752, after an absence from England of three years and a half. At Plymouth he painted two portraits, one of which was of the Rev. Zachary Mudge, vicar of St. Andrews, and the old friend of his father.

By the advice of his early patron, Lord Mount Edgecombe, Reynolds returned to London, and again took apartments for a short time in St. Martin's Lane, where he painted his celebrated portrait of Joseph Marchi, in a Turkish dress, a young Italian whom he had brought with him as an assistant from Rome. This picture, which was painted in a florid style somewhat after the manner of Rembrandt, attracted much attention, and among other visitors his old master Hudson went to see it, who, having examined it somewhat closely, is reported to have said, with an oath, 'Reynolds, you don't paint so well as you did when you left England.' This has been invariably imputed to Hudson as an expression of envy, yet it would be very difficult to reconcile an approbation of that head with his own practice, which was in a style diametrically opposed to it. Reynolds himself in after-life, upon seeing some portraits that he had painted thirty years previously, is said to have regretted that he had made so little progress. His execution in early life was very different from that of his latter years; his earlier manner was considerably more modest and less bold than his later, and proportionably more true to nature in consequence.

Reynolds's practice as a portrait-painter being now very considerable, he took a house in Great Newport Street, where he continued some years. One of his first works of value was a portrait of the then Duke of Devonshire, but that which established his fame as the first portrait-painter of his country was a full-length of his friend Commodore Keppel standing upon the sea-shore. It was about this time that he contracted an intimacy with Dr. Johnson, which only ended with the death of the latter. When Reynolds painted in St. Martin's Lane, his prices were for a head 10 guineas, a half-length 20 guineas, and for a whole length 40 guineas; in Newport Street they were at first respectively 12, 24, and 48 guineas, but his practice increased so rapidly that in 1758 he raised his price to 20 guineas for a head, and in 1760 to 25 guineas, the other sizes being in proportion.

At this period he was in the habit of receiving six sitters a day, and he valued his time at five guineas an hour. In 1761 he purchased a house in Leicester Square, where he fitted up an elegant painting-room, and built a spacious gallery for his rapidly-increasing collection of works of art; and here he resided the remainder of his life. His practice had now become so great, that he employed several assistants, of whom Marchi, the Italian, and Peter Toms, the celebrated painter of draperies, were the principal. This year the first public exhibition of works of art took place, in the room of the Society of Arts, in which Reynolds had four pictures; and in the exhibition of the following year, in Spring Gardens, he exhibited his portrait of Lord Ligonier on horseback (now in the National Gallery), and one of Sterne. These pictures, though not to be compared with his later performances, from a peculiarity of style and a richness of effect which distinguished them from the works of other artists, attracted universal attention, and established Reynolds as the favourite of the public. In 1762 he painted his celebrated picture of Garrick between Tragedy and Comedy; it was bought by the earl of Halifax for three hundred guineas, and has been engraved by Fisher. Dr. Johnson, in a letter written this year to Baretti, says, 'Mr. Reynolds gets six thousand a year.' In 1764 Reynolds and Johnson instituted the Literary Club, which was then limited to twelve members: Goldsmith and Burke were of the number.

Upon the foundation of the Royal Academy, in 1768, Reynolds was unanimously chosen president, and the honour of knighthood was conferred on him upon the occasion. The Academy was opened on the 1st of January, 1769, and the president delivered an appropriate discourse in commemoration of the event. Lecturing was no part of the duty of the president; it was a task which Sir Joshua imposed upon himself. He delivered altogether fifteen of these discourses, which have been translated into several languages, and have been generally and deservedly well received: they are too well known to require any particular comment here. They are certainly in many respects admirable; yet, with much sound and original criticism, they contain much also that is questionable.

In 1770 Sir Joshua raised his price for a head to thirty-five guineas. In 1773 he painted his celebrated picture of Count Ugolino with his Sons, from Dante: it was purchased by the duke of Dorset for four hundred guineas, and has been engraved by Dixon. This same year he proposed his plan of decorating St. Paul's Cathedral with a series of historical pictures, which was readily acceded to by Dr. Newton, bishop of Bristol and dean of St. Paul's; but Dr. Terrick, bishop of London, put a stop to the whole scheme, upon the plea that it was an introduction of popery: the other artists who had agreed to contribute works were West, Barry, Dance, Cipriani, and Angelica Kauffmann. This year is also memorable for two honorary distinctions which were conferred upon Sir Joshua; he was created Doctor of Civil Law by the university of Oxford; and was elected mayor of his native town, Plympton, a circumstance which gave him great gratification, and he presented the corporation with his portrait upon the occasion. About this time also he was elected member of the Imperial Academy of Florence, to which body he also sent his portrait. In 1779 he ornamented the ceiling of the library of the Royal Academy, in its apartments in Somerset House, with an allegorical painting representing Theory seated on a cloud, with the inscription 'Theory is the knowledge of what is truly Nature,' written upon a scroll in her hand. In this year he raised his price to fifty guineas for a head, which continued to be his charge during the remainder of his life.

In 1780 and the following years, Sir Joshua was engaged upon his great designs for the celebrated window of New College Chapel, Oxford, consisting of seven compartments for the lower range, containing the allegorical figures of the four cardinal and the three Christian virtues, Temperance, Fortitude, Justice, Prudence, Faith, Hope, and Charity; and above them the Nativity, lighted after the manner of the famous 'Notte' of Correggio. These designs were executed on the glass by Jervis of Dublin. The original design for the Nativity was purchased by the duke of Rutland for twelve hundred guineas, and was destroyed by the fire at Belvoir Castle in 1816: there is an engraving of it by Earlom.

In 1784 Sir Joshua painted his magnificent allegorical portrait of Mrs. Siddons as the Tragic Muse, a picture of its class perhaps unrivalled. According to Northcote, Sir Joshua valued this portrait at a thousand guineas; but it was purchased by W. Smith, Esq., for seven hundred: it has been engraved by Hayward. Upon the death of Allan Ramsay, this year, Sir Joshua was appointed principal painter in ordinary to the king. This year also he lost his old friend Dr. Johnson, who appointed him one of his executors, and bequeathed him his great French dictionary of Moreri and his own corrected folio copy of his English dictionary.

In 1786 he painted his Infant Hercules strangling the Serpents in the Cradle, for the Empress Catherine of Russia: it was sent to St. Petersburg, with two sets of Sir Joshua's discourses, one in French, the other in English, in 1789; and the following year, the Russian ambassador, Count Woronzow, presented him with a gold box, having the portrait of the empress upon the lid, set with large diamonds. His executors afterwards received fifteen hundred guineas as the price of the picture. This picture, which was remarkable for its rich effect of colour and forcible chiaroscuro, was the principal of Sir Joshua's historical pieces, and met with universal applause from the critics of the day. Even the eccentric Barry approved of it: he said 'the prophetical agitation of Tiresias, and Juno enveloped with clouds, hanging over the scene like a black pestilence, can never be too much admired, and are indeed truly sublime.' The effect of the tone and colour cannot be better expressed than by a painter of the day, who said that 'it looked as if it had been boiled in brandy.' The leading features of the composition were apparently taken from the 'Iconic' of the younger Philostratus on the subject: it has been engraved in mezzotinto by Hodges.

Sir Joshua painted three pictures for Alderman Boydell's Shakspere, the Cauldron Scene in Macbeth, Puck in Midsummer Night's Dream, and the Death of Cardinal Beaufort. For the first of these pieces the alderman paid Sir Joshua one thousand guineas, for the second one hundred, and for the third five hundred guineas.

Towards the end of 1791, a tumour, accompanied with inflammation, formed over his left eye; and being apprehensive lest the right should also be affected, he felt it necessary to desist from any further practice in his profession. He accordingly sent a letter to the council of the Academy, intimating his intention of resigning the office of president, on account of bodily infirmities; but he was induced to retain it upon the appointment of West as a deputy. He never again however resumed the chair; but died a few months afterwards, after a painful illness, of a disease of the liver, Feb. 23rd, 1792, in the sixty-ninth year of his age; and on his body being opened by Hunter, his liver was found to be more than double its natural size.

The body of Sir Joshua Reynolds, after lying in state in Somerset House, was buried with great pomp in St. Paul's Cathedral, where, some years after, a statue, executed by Flaxman, was erected to his memory.

The principal portion of his property, which amounted upon the whole to 80,000*l.*, he bequeathed to his niece, Miss Palmer, who shortly afterwards was married to the earl of Inchiquin, subsequently created marquis of Thomond. His collection of works of art sold for about 17,000*l.*, including several of his own works, and many unfinished and unclaimed portraits.

When we consider Sir Joshua's expensive habits and his liberal disposition, this large property enables us to form some idea of the immense patronage that he enjoyed. Upon the whole, his career from the beginning to the end exhibits an example of uninterrupted and brilliant prosperity that has perhaps never been surpassed. There are engravings from upwards of seven hundred of his works, mostly in mezzotinto. Northcote has given a list of about three hundred of his principal performances.

The day after Sir Joshua's death his eulogium from the pen of Burke, who was one of his executors, appeared in the papers. The following are extracts from this eloquent panegyric:—

'Sir Joshua Reynolds was on very many accounts one of the most memorable men of his time. He was the first Englishman who added the praise of the elegant arts to the other glories of his country. In taste, in grace, in facility, in happy invention, and in the richness and harmony of colouring he was equal to the greatest masters of the renowned ages.' 'He possessed the theory as perfectly as the practice of his art. To be such a painter he was a profound and penetrating philosopher.' 'His talents of every kind, powerful from nature, and not meanly cultivated by letters, his social virtues in all the relations and all the habitudes of life, rendered him the centre of a very great and unparalleled variety of agreeable societies, which will be dissipated by his death. He had too much merit not to excite some jealousy, too much innocence to provoke any enmity. The loss of no man of his time can be felt with more sincere, general, and unmixed sorrow.'

'As to his person,' says Northcote, 'in his stature Sir Joshua Reynolds was rather under the middle size, of a florid complexion, roundish blunt features, and a lively aspect; not corpulent, though somewhat inclined to it, but extremely active; with manners uncommonly polished and agreeable. In conversation his manner was perfectly natural, simple, and unassuming.' He was never married.

Sir Joshua Reynolds's literary productions, besides his discourses, were three contributions to the 'Idler,' some notes to Mason's translation of Du Fresnoy's 'Art of Painting;' a few notes for Dr. Johnson's edition of Shakspere, and his remarks upon the works of the Dutch and Flemish painters during his tour through Flanders and Holland in 1781. These last are full of admirable criticism, and display a rare discrimination of merits and demerits according to the intents and means of the various painters. It was during this tour that he first learnt to appreciate the wonderful powers of Rubens; he says of him, 'he was perhaps the greatest master in the mechanical part of the art, the best workman with his tools that ever exercised a pencil.' Several complete editions of his works have been published.

The partiality of British criticism has, with few exceptions, awarded Sir Joshua unqualified praise; he has been said to combine the beauties of Titian, of Rembrandt, and of Vandyck. 'To the grandeur, the truth, and simplicity of Titian,' says Northcote, 'and to the daring strength of Rembrandt, he has united the chasteness and delicacy of Vandyck.' That he combined many of the excellencies of the two former cannot be questioned, yet in style and execution he was more artificial than Titian, and in effect less powerful than Rembrandt; and he was certainly as conspicuous for their defects as for their beauties. It remains however yet to be shown that there are in the works of Sir Joshua any traces of the purity and severity of Vandyck, not to mention the powerful drawing and exquisite modelling, by which Vandyck has so well proved that individuality is eminently consistent with breadth and grandeur.

Reynolds has been justly said to be the founder of the British school of painting. Through a happy combination, and a judicious and powerful application of qualities, whether originating in natural feeling or acquired by selection from other masters, he struck out a new path in portrait, and by uniting graceful composition and breadth of light and shade with a rich and mellow tone of colouring, he invented a style of his own. This was a style, through its novelty and richness of effect, well calculated to captivate the taste of a public accustomed to the dry and feeble manner of the painters immediately preceding him, whether a Hudson, a Jervas, or a Kneller. But these attractive qualities, being the chief aim of the painter, naturally involved the sacrifice of those more solid properties of art through which alone true expression and individual character can be thoroughly attained, which we find more or less so well illustrated in the heads of Holbein, Raphael, and Vandyck, and which must always be imperfectly given when the features, though admirably placed, are merely indicated, however rich the colour, and however great the effect. The beauties of Sir Joshua's style were displayed to most advantage in the portraits of females and children, particularly the latter; and perhaps they are displayed to their utmost in the large fancy-piece of three ladies decorating a terminal figure of Hymen, in the National Gallery.

A great continental painter and critic (Mengs), whose own style however bordered upon an insipid imitation of the antique, has asserted that the principles and style of the English Reynolds were superficial and alluring. Although there may be less truth in this assertion than the foreign painter might have wished to imply, yet there is infinitely more in it than the partiality, or perhaps rather the biassed judgment of the English critic has hitherto enabled him to perceive. Reynolds's principal object was *effect*, yet with it he endeavoured to unite individual character; indeed his principle was that the likeness and individual character depended more upon the 'general effect' than upon the 'exact expression of the peculiarities or minute discrimination of the parts.' To this dangerous principle may be traced the characteristic defects of his style, of which the Holy Family, in the National Gallery, is a remarkable specimen. His great fear of falling into 'the vulgar error of imitating nature too closely,' and, while aiming at individuality, attaining only 'littleness,' led him into the opposite extreme of acquiring breadth at the expense of nature, by an almost total neglect of modelling. The endeavour to combine breadth with individuality to any great degree, with the means which Reynolds brought to the task, must have inevitably failed in every instance where the individual was not of a striking or marked character, as was the case in 'Lord Heathfield,' an admirable subject for Sir Joshua's pencil. These deficiencies might be concealed, but not supplied by any merits however great. When art differs from nature it is no longer an imitation of nature, but simply art; and notwithstanding the great vivacity of Sir Joshua's portraits, they are preeminently *works of art;* for instance, upon entering an apartment or a gallery which may contain specimens of his pencil, the hand of the artist is the first thing that strikes our attention, which is equally the case with engravings after his works; this is perhaps the only really infallible test of manner. The style of Raphael, who was the least mannered of all painters, because the most true to nature (Perugino's manner must not be confounded with Raphael's style), affords in this respect a striking contrast to Sir Joshua's; even the few specimens of his great works, in the collection of Marc Antonio's prints in the British Museum, show this satisfactorily.

Perhaps the greatest solecism in the current criticism upon Reynolds's style, and one of his reputed services to art, is that he 'exalted portrait to the dignity of history.' Now, whatever dignity an historical piece may possess must be obtained from the human character, whether it exist collectively or merely individually, and it can only be acquired through the principles of portraiture, of which character, and therefore its quality or inherent dignity, constitutes the essential principle. This has been well and often illustrated by Velasquez, Vandyck, and the great Italian masters in portrait, and in a much more eminent degree than it was ever done by Reynolds; perhaps in this respect Sir Joshua's most successful portrait is that of Lord Rodney. It is a quality generally less evident in portrait than in history, since it requires far greater skill to arrange effectively a single figure where the means are so limited, than to obtain a comparatively grand effect when some story is to be told through a variety of actors. In such case however the dignity of the whole can only arise from the individual dignity of the distinct or most important actors; for although it is an essential quality of grand composition, dignity forms no part of grouping. This may be illustrated by two great examples:—Paul, in the Cartoon of Paul preaching at Athens; and Andrea Doria, in the portrait by Sebastian del Piombo. The former would lose no portion of its proper dignity if separated from the surrounding groups; nor would the grand figure of Andrea Doria acquire any additional dignity, if the figures, which the imagination may suggest as appropriate actors in the scene, were supplied.

So great has been the influence of Reynolds's works, and so deeply has his style affected opinion upon art in England, that it has become the recognised standard of excellence in portrait. During the prevalence of such a conventional system of art or imitation, the true fountain of all criticism, an impartial comparison with nature in all her variety, cannot exist. The ambition of the young aspirant is to imitate the style or to catch the peculiarities of the universal favourite; he studies the works of artists rather than those of nature, and thus neglects the very means by which his models attained to fame and excellence. In England, Reynolds supplanted nature, and he became the painter's model. Hence arose that style of art denominated the English school, which is conspicuous for many of the defects of its founder and for few of his beauties; and necessarily so, for where unqualified admiration confounds beauties with defects, the only result of indiscriminate imitation must be the propagation of the defects alone, which, being the more evident and palpable, are so much the more easy of imitation. Thus Reynolds's *manner* became the English *style*. This circumstance is the greatest tribute that could be paid to his really great powers, for few artists have formed a school, fewer still have led a nation. All things however that are not founded upon the solid basis of truth, but only on imperfect or partial views of nature, can have no permanent effect, and the influence of Reynolds over British taste is now rapidly declining. The noble designs of Flaxman, by directing taste into another channel, and pointing out other objects of excellence, are calculated greatly to improve the character of poetic and historic art; though the effects of these truly classic compositions will be more conspicuous in the works of the rising generation of artists.

The deficiencies of Sir Joshua's style are more striking in his historical pieces than in his portraits. Its great characteristic, *effect*, and effect founded upon colour, is incompatible with the qualities peculiarly characteristic of the grand style—simplicity, severity, and dignity of expression, which can only result from the union of a grand style of design with a subdued colour. It has been often remarked that Sir Joshua's enthusiastic admiration, expressed in his discourses, of the works of Michael Angelo and the Roman school, strangely contrasts with his own style and practice, for the various styles of art certainly do not exhibit a greater contrast than that which exists between the florid *unfinish* and feeble line of Reynolds, and the sombre colour and the vigorous design of the Roman school. Reynolds's apology for this inconsistency of principle and practice was, that he suited his style to the taste of his times; yet it is an incontestible fact that he himself formed this taste. And although it is doubtful whether he preferred present prosperity to future fame, the style which he adopted has determined the ultimate fate of his works. To use his own words, 'Present time and future may be considered as rivals, and he who solicits the one must expect to be discountenanced by the other.'

A detailed account of events and incidents of Reynolds's life is given in the elaborate work, in two volumes, by Northcote.

REYNOLDS. [THEOLOGY.]

REZAT, THE CIRCLE OF THE (*der Rezatkreis*), in the kingdom of Bavaria, is situated between 48° 41′ and 49° 45′ N. lat. and between 10° 5′ and 11° 40′ E. long. It is bounded on the north-west by the circle of the Lower Main, on the north-east by that of the Upper Main, on the east by that of the Regen, on the south by that of the Upper Danube, and on the west by the kingdom of Wirtemberg. The area is about 3000 square miles. The circle is traversed by several chains of hills, to which recent geographers have given the name of the Franconian Jura. With the exception of some few points, they are of no considerable elevation. These hills are capable of cultivation, and their sides are covered with forests. No other circle in Bavaria contains so many fertile valleys and such a rich soil. Of the great German rivers only the Danube just touches the circle for a short distance on the south, and receives, of the other rivers, only the Wernitz and the Altmühl. The principal river is the Regnitz, which is formed by the junction of the Rednitz and the Pegnitz, the latter again being formed by the junction of the Upper and the Lower Rezat. All the other rivers fall into the Regnitz, which itself falls into the Main near Bischberg, in the circle of the Upper Main.

No circle in the kingdom is better cultivated or more productive than the Rezat. All kinds of corn are cultivated, as well as millet, pulse, garden fruits, flax, hemp, tobacco, madder, and hops, and in such abundance that all, except madder, produce a surplus for exportation. The forests are very considerable. Most of them consist of firs, but there are some woods of oak, elm, &c.

The breed of cattle is a chief source of the wealth of the inhabitants, and is perhaps the best in the kingdom. The oxen (which are employed in agriculture, as well as horses) are large, strong, and very numerous; the breed of horses has been much improved by foreign importation; the breed of sheep continues to be improved by the importation of Merinos. But few swine and bees are bred, the people in these parts having a dislike to both. Large game, as deer and wild boars, is scarce; but small game, hares, partridges, &c., abounds. Domestic poultry is not so much bred as it might be. Fish abound both in the rivers and meres. There are no lakes. The circle is not rich in minerals. It produces very little iron, but has some useful kinds of stone, marble, clay, &c. It produces no salt, since Gerabronn has been ceded to Wirtemberg.

Of all the circles of Bavaria this has indeed the greatest number of manufactories, and contains several great manufacturing towns [FURTH, NURNBERG, SCHWABACH], and some of smaller importance (Erlangen [ERLANGEN], Roth, Dinkelsbühl), yet the products of the circle are almost entirely agricultural; the manufactures of woollen, cotton, linen, leather, stockings, &c. in the small towns, and by the country people, being quite unimportant.

The Rezat is the most densely peopled circle in Bavaria. The inhabitants, now 550,000, with the exception of the Jews and a few foreigners, are of German descent, and speak the High German-Franconian dialect. At least four-fifths of the inhabitants are Lutherans; the Calvinists are few. Of other religious persuasions, the Roman Catholics are the most numerous. The Jews are also numerous.

We take this opportunity to observe, that the king of Bavaria has changed the names of all the circles, or rather restored the antient historical names, as follows:—

	Late Names.	Present Names.
1.	Circle of the Isar.	Upper Bavaria.
2.	„ „ Lower Danube.	Lower Bavaria.
3.	„ „ Rhine.	The Palatinate.
4.	„ „ Regen.	Upper Palatinate and Ratisbon.
5.	„ „ Upper Main.	Upper Franconia.
6.	„ „ Rezat.	Middle Franconia.
7.	„ „ Lower Main.	Lower Franconia and Aschaffenburg.
8.	„ „ Upper Danube.	Swabia and Neuburg.

A few, but inconsiderable, changes have been made, by taking some districts from one circle and giving them to another.

RHÆ'TIA appears properly to have comprehended the whole country between the north of Italy and the Danube, and consequently to have included Vindelicia. Dion Cassius (liv., 22), in his account of the conquest of the Rhæti and Vindelici by Drusus and Tiberius, only mentions the Rhæti. Strabo often speaks of them (iv., p. 193, 206; vii., p. 449) as if they were only one people; and Tacitus in several passages appears to include Vindelicia in the province of Rhætia. In the time of Augustus however these two countries formed two separate provinces (Vell. Pater., ii., 39; Aurel. Vict., *Epit.*, c. i.; comp. Suet., *Aug.*, 21), of which Rhætia was bounded on the west by the Helvetii, on the east by Noricum, on the south by Gallia Cisalpina, and on the north by Vindelicia, from which it was separated by the Brigantinus Lacus (Boden See, or the Lake of Constance) and the river Œnus (Inn). It included the greater part of the Tyrol and the eastern cantons of Switzerland. The province of Vindelicia is treated of in a separate article.

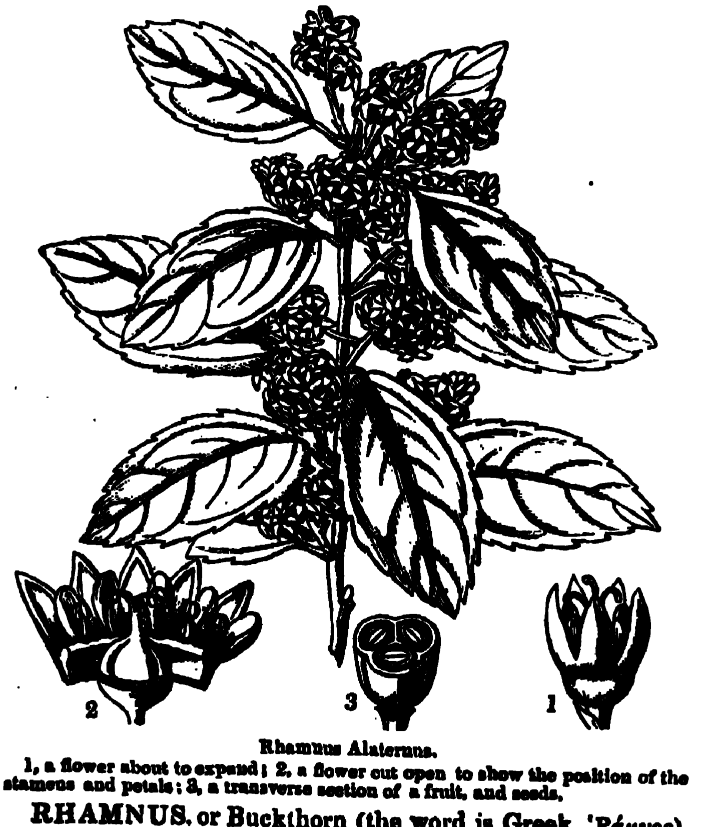
The Rhæti are said to have been a Tuscan people, who were expelled from Italy by the Gauls, and who settled in the country afterwards called Rhætia, under a leader named Rhætus. (Plin., iii. 24; Justin, xx. 5; Liv., v. 33.) They are first mentioned by Polybius (xxxv. 10, § 18) as one of the people through whose country there was a passage across the Alps. They were a brave and enterprising race, and for a long time committed constant robberies in Gaul and the north of Italy. Augustus at length sent Drusus against them (B.C. 15), who subdued the southern part of the country, and delivered Italy from their depredations; but as they still continued to trouble the province of Gaul, Tiberius also was sent against them, who attacked them near the Boden See, and reduced the whole country. The greater part of their youth was carried away, and only sufficient left to cultivate the land. (Dion Cassius, liv. 22; Strabo, iv. 206.) The victories of Drusus and Tiberius are celebrated by Horace (*Carm.*, iv. 4, 14).

The great chain of the Alps passes almost through the centre of this province, and was called the Alpes Rhæticæ (Tac., *Germ.*, c. 1; *Hist.*, i. 70), which were inhabited almost to the top by different tribes of the Rhæti (Strabo, vii. 392). Several large rivers rise in these mountains, of which the most important are the Rhenus (Rhine), the Athesis (Adige), the Addua (Adda), and the Œnus. The valleys between these mountains were very fertile, and were particularly celebrated for their grapes, from which excellent wine was made. (Strabo, iv., p. 206.) The Rhætian wine was the favourite wine of Augustus. (Suet., *Octav.*, 77.)

The Rhæti were divided, according to Pliny (iii. 24), into many states or tribes. Of these the most important were: the Lepontii, in the south-western part of the province (Cæs., *Bell. Gall.*, iv. 10; Strabo, iv., p. 204); the Tridentini, in the south-eastern; the Gerauni, whom Horace (*Carm.*, iv. 14) mentions, east of the Lepontii; the Vennones, near the sources of the Attagis (Etsch), which flows into the Athesis; the Brixentes, north of the Tridentini; the Brenni, or Breuni, north of the Rhætian Alps; and the Brigantii, in the north-western part of the province, on the borders of the lake Brigantinus. The only town of any importance in Rhætia was Tridentum (*Trent*) on the Athesis, the capital of the Tridentini.

RHAGÆ. [PERSIA.]

RHAMNA'CEÆ, a natural order of Exogens, remarkable for having a valvate calyx, hooded petals, opposite to which their stamens are inserted into the tube of the calyx, and a superior or half-inferior fruit which is either dry or fleshy. The species are all shrubs, with small greenish or inconspicuous flowers. Those most common in this country are the Rhamnus frangula (Black Alder), Rhamnus catharticus (Buckthorn), Paliurus australis (Christ's Thorn), and the evergreen Alaternus, a kind of Rhamnus. The useful species are of some importance: Rhamnus catharticus and several others have purgative berries; Rhamnus infectorius yields the French berries of the shops employed for dyeing yellow; the fruit of the Jujube, Zizyphus jujube and vulgaris, is subacid and eatable, and the species are cultivated for it in the south of Europe and the temperate parts of Asia; Zizyphus Lotus gave its name to the Lotophagi, or Lote-eaters, of Africa; and Rhamnus frangula is extensively cultivated for the manufacture of charcoal. [PALIURUS; RHAMNUS; ZIZYPHUS.]



Rhamnus Alaternus.

1, a flower about to expand; 2, a flower cut open to show the position of the stamens and petals; 3, a transverse section of a fruit, and seeds.

RHAMNUS, or Buckthorn (the word is Greek, 'Ράμνος), a widely diffused genus of the natural family of Rhamnaceæ, chiefly found in the temperate parts of Europe, in Siberia, and in the Himalayas at elevations of 6500 feet; also in the New World, and at the Cape of Good Hope.

The genus is characterised by having an urceolate 4-5-cleft calyx. Petals wanting, or emarginate. Anthers ovate, 2-celled. Disk thin, overspreading the tube of the calyx. Ovary superior, 3- or 4-celled. Styles 3 or 4, distinct or united. Fruit fleshy, with 3 or 4, or, in consequence of abortion, 2 fibrous indehiscent stones.

The berries of one species, the Rhamnus catharticus, have long been known for their purgative properties, and still continue to hold a place in several Pharmacopœias. This property is participated in by those of other species, as well as by their inner bark. The berries of several species of Rhamnus form articles of commerce from the Mediterranean, under the name of French, Turkey, and Persian berries, grains d'Avignon, &c., being valued on account of the colouring-matter which they yield, and which varies from yellow to green. This M. Brongniart supposes to be owing rather to different degrees of ripeness than to essential differences in nature. Sap-green is a mixture of the juice of these berries with those of some others. R. infectorius, saxatilis, amygdalinus, catharticus, and Clusii are the species generally employed; some for dyeing morocco leather of a yellow colour, others for dyeing wool, and the bark of some for striking a black with the salts of iron. The Lycium of the antients is supposed by some to have been a species of Rhamnus [LYCIUM]; hence also one species has been called R. Lycioides: it has a hard yellow wood. Another, R. theezans, is said to be employed as a substitute for tea even in China.

RHAMNUS CATHA'RTICUS (called also Spina cervina, hence Buckthorn), an indigenous shrub, flowering in May, and ripening its berries in September, at which time they are collected. The berries are about the size of a peppercorn, black externally, but within of a deep violet, the pulp enclosing three or four seeds. The taste is nauseous and repulsive at last, though at first sweetish and only bitter. They contain a peculiar extractive, a colouring principle, acetic acid, and gum. The fresh and dried berries, the expressed juice, or a syrup prepared from them, all possess purgative properties, exemplified in that form which has led to the designation *hydragogue*. Its action is attended with much sickness, griping, and thirst. All the forms of exhibition are objectionable, but particularly the berries, either fresh or dried: yet this acrid and almost poisonous article is retained in practice, and is a common domestic medicine, especially for young children, the most unsuitable of all for its employment. It should be restricted to the arts, in which it is serviceable, being the source of the pigment called sap-green or bladder-green.

The berries of several different shrubs are said to be substituted for those of the R. catharticus; a circumstance which is fortunate, if any more harmless are made to replace them. Buckthorn berries are themselves used to adulterate cubebs.

RHATANY. [RATANY; KRAMERIA.]

RHAZES, or **RAZES**, the common Latinized name of one of the most famous of the antient Arabic physicians, who is also sometimes called Rasæus, Rases, Rasis, Razæus, Razeus, Razi, Rhases, Rhazeus, Rhazis, or Arrasi. His names (as given by the anonymous author of the 'Arabic. Philosoph. Biblioth.,' quoted by Casiri, 'Biblioth. Arabico-Hisp. Escur.,' tom. i., p. 264) were Mohammed Ben-Zakaria Abu-Bekr Al-Razi. He was born and brought up at Rai, the most northern town (according to D'Herbelot, *Biblioth. Orient.*) of Irak Ajemi, and showed from his youth a great inclination for the sciences. He acquired great philological and philosophical knowledge, but chiefly devoted himself to music; and even in his thirtieth year, he was only known for his skill in singing and playing on the guitar. He afterwards, when past the age of forty (Abulfeda, *Annal. Musl.*, tom ii., p. 347) applied himself exclusively to the study of medicine and philosophy, and repaired to Bagdad, where Ibn Zein Al-Taberi was his instructor, from whom he acquired much important information. Upon his return to Rai, he became director of the hospital in that town, and afterwards of that at Bagdad. He was held in great estimation by the contemporary princes, and was called the Galen of his time. He travelled much, and visited both Jerusalem and Africa: he is said also to have visited Spain (Leo Afric., *De Viris Illustr. Arab.*, cap. 6; apud Fabric., *Biblioth. Græc.*, tom. xiii.), where, in passing through the streets of Cordova, he saw a crowd collected round the body of a man who was said to have just fallen down dead. He caused him to be beaten all over with rods, and particularly on the soles of his feet, and thus in less than a quarter of an hour restored him to life. Upon being asked about the invention of this singular remedy, he said that he had seen it used with success in a similar case by an old Arab; and added, that 'experience is of more use than a physician.'[*] To Prince Al-Mansour, to whom he dedicated his work entitled *Ketáb Al-Mansouri*, 'Liber ad Al-Mansorem,' he wished also to present his 'Confirmatio Artis Chimiæ,' and left Bagdad for this purpose. The prince was much pleased, and gave him a thousand dinars;[†] but wished at the same time to see a trial of the discoveries described in the book, and granted a considerable sum for the preparation of the necessary apparatus. The experiments however did not succeed; which so enraged Al-Mansour, that he called him a liar, struck him a violent blow on the head, and ordered him to pack up his things quickly and go back to Bagdad. (Ibn Khallikán, *Vitæ Illustr. Viror.*) This blow is said to have afterwards occasioned his becoming blind, but Abulfaraj (*Hist. Dynast.*, p. 291) and Casiri (*loco cit.*) attribute this misfortune to eating beans. At first he wished to have an operation performed; but as the surgeon could not tell him how many membranes the eye contained, he refused to let him touch his eyes; and when some one represented to him that the operation might nevertheless succeed, he replied, 'I have seen so much of the world, that I am wearied of it.' He was so charitable and liberal, that he often gave money to his poor patients, and lived himself in poverty. He died at an advanced age, either at Bagdad or Rai, A.H. 311, or more probably 320 (A.D. 923 or 932), under the khalifat of Moctader Billah, the eighteenth of the race of the Abbassides. (Wüstenfeld, *Gesch. der Arab. Aerzte.*)

His works amounted to more than two hundred, and the bare titles, as given by the anonymous author quoted above, take up four folio columns in Casiri; of these only those that have been published can be noticed here; and for a more complete account of his medical opinions and practice, the reader may consult Freind's 'Hist. of Physic,' Sprengel's 'Hist. de la Méd.,' and Haller's 'Biblioth. Medic. Pract.' The principal work of his that we possess is called *Al-Háwi*, 'Continens.' An attentive perusal of this book is sufficient to prove that Rhazes could not have published it in its present form, as the diseases are mentioned without the least order; the treatment of many of them is not touched upon; the author is sometimes quoted in the third person (*Rhaz. Contin.*, lib. vi., cap. 1, pag. 125, col. 2; lib. viii., cap. 2, pag. 176, col. 4); and lastly, one meets with the names of several Greek physicians more modern than Rhazes. To all these arguments against the authenticity of the work may be added the important testimonies of Haly-Abbas and Abulfaraj. The former gives Rhazes all the praise he really deserves; but adds, that the 'Al-Háwi' is certainly not the most evident proof of his science and good taste, but that probably he only left the work to his descendants in the form of an unfinished sketch. (Haly-Abbas, *Prolog.*, pag. 6, ed. Lugd., 1523, 4to.) Abulfaraj says positively that the authentic 'Al-Háwi' was never published. (*Chron. Syr.*, p. 172. Ed. Bruns et Kirsch.) Notwithstanding these unanswerable proofs against the authenticity of the work, it cannot be doubted that great part of it was written by Rhazes; and it will always be considered one of the most valuable repositories of the medical science of the Arabians. (Sprengel, *Hist. de la Méd.*) The original Arabic has never appeared; but several Latin translations under the various titles Elhavi, Helchauy, Elchavi, Elkavi, Hawi, &c.) were published in the fifteenth and sixteenth centuries. The first edition is scarce, and was printed at Brescia (*Brixiæ*) 1486, fol., 2 vols., in black-letter, with two columns in a page, under the following title: 'Liber Elhavi, seu Totum Continentis Bubikir Zacharie Errasis Filii, traducti ex Arab. in Latin. per Mag. Ferragium, Medicum Salerni,' &c. The last edition is probably that by Hieron. Surianus, Venet., 1542, fol.

The most celebrated of his works is his treatise on the small-pox and measles, which is the oldest account that we possess of these two diseases. 'He was not however the first writer on the subject, for he himself quotes from Aaron and other of his countrymen, who had formerly given imperfect histories of these diseases. The treatment of them, as described by him, is sufficiently accurate and judicious, that is to say, he directs in general to bleed at the commencement, then to give cooling and acidulated draughts, with gentle laxatives, &c.; and he properly recommends to pay particular attention to the throat and eyes.' (Mr. Adams, Append. to Barker's Lempriere, 1838.) Of this little work there is an edition in Arabic and Latin, by J. Channing, Lond., 1766, 8vo. It was printed from a manuscript at Leyden, and Dr. Russell says (Append. to *Nat. Hist. of Aleppo*) that he had the book collated with other MSS. in the East, and that the readings were upon the whole found very exact. It has been translated into several antient and modern languages. A Greek translation was published by Jac. Goupylus, at the end of his edition of Alexander Trallianus, Lutet. Par., 1548, fol., entitled 'Rhazæ de Pestilentia Libellus ex Syrorum Lingua in Græcam translatus.' It was translated into Latin by Georg. Valla, Basil., 1529, 8vo., with Michael Psellus, 'De Victus Ratione;' by Nic. Macchellus, Venet., 1555, 8vo.; by Salomo Negri, the Syrian, assisted by J. Gagnier and Th. Hunt, and published by Dr. Mead, in his work, 'De Variolis et Morbidis,' Lond., 1747, 8vo.; Channing's translation was republished by Haller, in the seventh volume of his 'Medicæ Artis Principes,' Lausanne, 1772. It was translated into French by Sébast. Colin, Poitiers, 1556, and by J. J. Paulet, in the second volume of his 'Hist. de la Petite Vérole,' 1763, Paris, 12mo., and there is an English translation in the English edition of Dr. Mead's medical works.

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[*] A somewhat similar story is told of Asclepiades (Pliny, *Hist. Nat.*, vii. 37; xxvi. 8; Celsus, *De Med.*, ii. 6; Apuleius, *Florid.*, lib. iv., p. 362) and of several other physicians, both in antient and modern times (*Cyclop. of Pract. Med.*, vol. iii., p. 316): among the rest, a very curious one is told by Ibn Abou Osaibiah, *Oioun al-anba fi tabacat al-atebba*, 'Fontes Relationum de Classibus Medicorum,' cap. 12, of Salih Ben Bahlah, an Indian physician at the court of Haróun Al-Rashíd. [SALIH.]

[†] The dinar (derived from the Greek δηνάριον) was a gold coin, equal at first to twenty, and afterwards to twenty-five dirhems (Casiri, *Biblioth. Arabico-Hisp. Escur.*, tom. ii., p. 173); and is commonly supposed to have been worth about a Venetian zecchin (D'Herbelot, *Biblioth. Orient.*), or to a German ducat (Freytag., *Lex. Arab.*). The sum given to Rhazes would therefore amount (if we reckon the dinar as 9*s.* 4½*d.*) to £468 15*s.*

The ten books, dedicated to Al-Mansor, *Ketáb Almansóuri*, 'Liber ad Almansorem,' contain a complete system of medicine, drawn from Arabic and Greek sources. The first book is on anatomy and physiology; the second, 'De Significationibus Temperaturarum;' the third, 'De Alimentis et Simplicibus;' the fourth, 'De Sanitatis Tuendæ Ratione;' the fifth, 'De Morbis Cutis, et de Cosmeticis;' the sixth, 'De Victu Peregrinantium;' the seventh, 'De Chirurgia;' the eighth, 'De Venenis;' the ninth, 'De Curatione Omnium Partium;' and the tenth, 'De Febribus.' The writers from whom the work is chiefly compiled are Hippocrates, Galen, Oribasius, Paulus Ægineta, and Aëtius. It contains an excellent treatise on the qualities necessary for a physician (Tract. iv., cap. 32, pag. 78, ed. Lugd., 1511, 8vo.), in which he declares that a person of much learning and little experience is more to be trusted than one of much experience and little learning; for he adds, how is it to be supposed that the private stores of any one individual should be at all worthy to be compared with the accumulated treasures of antiquity? There is also a very curious chapter (Tract. vii., cap. 27, pag. 123) on quacks and impostors, which has been translated and inserted by Freind, in his 'History of Physic.' He is said by Jo. Bapt. Silvaticus (*Controv. Med.*, sec. 14) to be the first person who recommended intoxication once or twice a month (*Almans. Tract.*, iv., cap. 5, pag. 64), which precept was repeated by Avicenna (*Cantic.*, part ii., sec. 34, pag. 383, ed. Venet., 1564), and others, and vigorously opposed at Paris in the seventeenth century, in two theses, by Hommets and Langlois. The ninth book was for several centuries one of the most celebrated text-books for medical students, but, notwithstanding its fame, Sprengel and Haller both declare that it contains nothing original. The Al-Mansor to whom the work is dedicated has by some been supposed to be the caliph of Bagdad, who lived above two centuries before the time of Rhazes, by others a prince of Cordova, who lived long after. Rhazes himself solves the difficulty, and says (*Antidotar. Prolog.*, pag. 78, b. ed. Venet., 1500) that he was a prince of Khorassân (*domino Corascem*), and nephew of the caliph Moktasi, named Al Mansóur Ibn Ishac Ibn Israel Ibn Ahmed. The whole of the Arabic original of this work has never been published, but a small extract (lib. ix., cap. 7) is inserted, with a Latin translation, in Reiske's 'Opusc. Med. ex Moniment. Arab.,' p. 70, sq. The first Latin translation was published with several other of his smaller works, Mediol., 1481, fol., in black-letter; the last edition came out at Basel, 1544, fol. There are also several other works that have been published with the 'Liber ad Almansorem,' *e.g.* 'Liber Divisionum,' 'Aphorismi,' 'De Juncturis,' 'Antidotarium,' 'De Morbis Infantum,' 'Introductio in Medicinam,' 'De Calculo Renum et Vesicæ,' 'De Facultatibus Partium Animalium,' &c. None of these little works contain anything of much importance.

RHEA. (Ornithology.) [STRUTHIONIDÆ.]

RHE'GIUM (in Greek, *Rhegion*, Ῥήγιον), now Reggio, one of the oldest Greek towns in Italy, is situated on the Fretum Siculum, or strait which divides Italy from Sicily. Rhegium was a colony of the Chalcidians, who were joined by a party of Messenian emigrants who left their country during the first quarrel between Messene and Sparta, in consequence of the affair of Limnæ. (Strabo, p. 257.) Its name Rhegion is said to be derived from a Greek verb (ῥηγ-νυ-μι) which means to tear or rend asunder, from a tradition of a physical convulsion by which Sicily became detached from the continent of Italy. (Strab., p. 258.) Both the town and the name probably existed previous to the establishment of the Chalcidian colony, as Diodorus and other antient writers place its foundation in the Heroic times.

After the taking of Ithome, and the end of the first Messenian war, a fresh colony of Messenians, led by Alcidamas, settled at Rhegium about 723 B.C.; and after the capture of Eira, a third party of Messenian emigrants, led by two sons of Aristomenes, joined their countrymen at Rhegium, which became a very populous and flourishing city, and extended its dominion over other towns and districts. Charondas of Catana is said to have compiled a code of laws for Rhegium. The government appears to have been a kind of open aristocracy, which, according to some accounts, was vested in one thousand of the citizens.

About 494 B.C., Anaxilaus, a citizen of Rhegium, of a Messenian family, usurped the supreme power. He took the town of Zancle on the opposite side of the strait, and colonised it with his Messenian countrymen, who gave it the name of Messana. [MESSENIA.] The poet Simonides composed a poem on the occasion of Anaxilaus having gained the prize at the Olympic Games with his mules. Anaxilaus married a daughter of Therillus, tyrant of Himera, who, being afterwards defeated by Theron of Agrigentum, took refuge at Carthage. Anaxilaus and Therillus invited the Carthaginians to the first invasion of Sicily (480 B.C.), which was defeated by Gelon of Syracuse. Anaxilaus died shortly after, and his sons were subsequently driven away from both Messana and Rhegium. The towns then became independent of each other, but remained allied by the ties of a common origin, and both joined the league of Naxus, Leontini, Catana, and other towns of Sicily, of Chalcidian origin, against Syracuse and the other Dorian cities. This contest led to the first Athenian expedition (427 B.C.), which came to the assistance of the allies. The harbour of Rhegium became the station of the Athenian fleet, and the Rhegini joined the Athenian forces. (Thucyd., iii., 86, 88.) After several desultory combats, the Sicilian towns agreed to a peace among themselves, and the Athenian forces returned home. During the second Athenian expedition against Syracuse, which ended so fatally for the Athenians, Rhegium remained neutral. Afterwards a long struggle began between Rhegium and Dionysius the elder, tyrant of Syracuse, which terminated with the ruin of Rhegium. Dionysius, wishing to strengthen himself by alliance with the Greek cities of Italy for his impending contest against Carthage, sent to ask one of the maidens of Rhegium for a wife. The Rhegians, irritated against Dionysius for his treatment of Naxus and Catana, the citizens of which he had driven away, and sold many as slaves, replied that they could only give him the daughter of their public executioner. Dionysius then applied to the Locrians, who gave him in marriage Doris, daughter of one of their chief citizens, and from that time he vowed vengeance against Rhegium. After having defeated the Carthaginians, he sailed from Syracuse with 100 galleys and a large body of men, which he landed near Rhegium. They scaled the walls, and were near taking possession of the town, when a fire broke out, and compelled them to retire. A new expedition from Carthage against Syracuse obliged Dionysius to leave Rhegium in peace for a time. Having again defeated the Carthaginians, Dionysius equipped a fleet of 120 galleys, with an army of 20,000 foot and 1000 horse, with which he landed near Locris, and then ravaged the territory of Rhegium. But the towns of Magna Græcia sent assistance to Rhegium; and a storm arising, in which many of the Syracusan ships were wrecked on the coast, Dionysius was obliged to retire to Syracuse (390 B.C.). The next year he came again to Italy, besieged, took, and destroyed Caulon, defeated an army of the Greek Italian cities, and obliged them to separate themselves from Rhegium, which he besieged again in the following year with a large force. The Rhegians made a brave resistance, but they were compelled to surrender through famine (387 B.C.). Many of the inhabitants were found dead; fifteen thousand of the remainder were sent to Syracuse as slaves; some of the wealthiest ransomed themselves. Python, their commander, was put to a cruel death with all his family by Dionysius, who rased the walls of Rhegium, and obliged the neighbouring towns of Magna Græcia to pay allegiance to him. Under his successor, Dionysius the Younger, Rhegium recovered its independence, and gradually some part of its former prosperity. After the expulsion of Dionysius the Younger from Syracuse, and the death of Timoleon, Rhegium was again besieged by the Syracusans, when Agathocles, himself an exile from Syracuse, came to its assistance with a party of his emigrant countrymen, and obliged the besiegers to raise the siege (317 B.C.). After the death of Agathocles, his numerous Campanian mercenaries, who were called Mamertines, being dismissed from the Syracusan service, took possession of Messana, and of all the property of the former inhabitants.

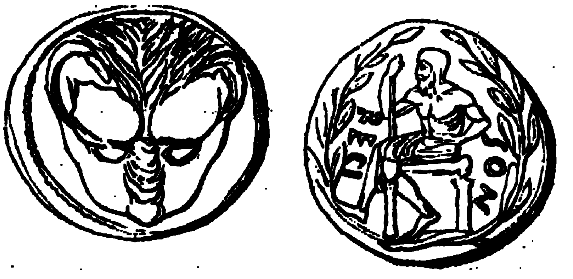
Not many years after, while Pyrrhus was waging war in South Italy and Sicily, Rhegium applied to Rome for assistance. The Romans sent a body of 4000 men, raised in the Latin colonies in Campania. These auxiliaries, finding themselves far from Rome, broke through all the restraints of discipline, and rising against the peaceful inhabitants whom they had been sent to protect, killed most of the men, took possession of their houses and property, and appropriated their wives and daughters to themselves. After the final retirement of Pyrrhus from Italy, the Roman senate sent the consul Genucius Clepsina with an army to punish the traitors. The Campanians defended themselves obstinately, and when at last they surrendered at discretion, they were reduced to a few hundreds, who were all put to death about 270 B.C. This happened shortly before the beginning of the first Punic war. The surviving citizens of Rhegium were restored to their houses and property, and to their municipal independence under the protection of Rome. Rhegium recovered its prosperity, and was a place of importance to Rome on account of its neighbourhood to Sicily. The Aquilian road terminated at Rhegium. The town was almost destroyed by an earthquake just before the breaking out of the Marsian war. In the time of Strabo, Rhegium, Tarentum, and Neapolis were the only towns of the numerous Greek colonies in Italy that retained the Greek language, manners, and customs. (Strabo, p. 253.)

After the fall of the Western empire, Rhegium remained subject to the Eastern emperors, and its archbishop was metropolitan of the whole country of the Bruttii. The Saracens from Sicily took possession of Rhegium, and planted a number of date-trees in the neighbourhood, a few of which have perpetuated themselves to our times. (Swinburne, *Travels in the Two Sicilies.*)

Rhegium was taken by the Normans in the eleventh century, since which time it has always been a part of the kingdom of the Two Sicilies.

In the sixteenth century Reggio was sacked three times by the Turks, in 1543 by Barbarossa, again in 1558, and lastly in 1593. The great earthquake of Calabria, in 1783, completely ruined the town of Reggio; not a single building remained entire. Reggio has been since rebuilt on a regular plan; it spreads along the declivity of a hill down to the sea. A wide street, called La Marina, runs along the sea-shore, and another street, parallel to it, runs through the centre of the town, and is intersected at right angles by various streets. The view of the opposite coast of Messina and its verdant hills, backed by the huge mass of Ætna, is truly magnificent. The Apennines near Reggio are rugged and bare, but the plain around Reggio is extremely fertile, and the ground is very valuable, most of it being laid out in orange and lemon plantations. The extracting of an essence from the rind of the orange and lemon, and the rearing of silk-worms, constitute important branches of industry. Reggio is a great nursery of orange and lemon plants for all parts of the kingdom. The climate is temperate, and the atmosphere remarkably pure. The population of Reggio amounts to nearly 20,000. The inhabitants are lively and sociable, and are mostly in easy circumstances; the women are good-looking, and it is altogether one of the pleasantest towns in the kingdom of Naples. [CALABRIA.]

The antient port no longer exists. The small craft of modern Reggio anchor a little to the north of the town, opposite the village of Pentimele. Reggio is about eight miles south-east of Messina.



Coin of Rhegium.

British Museum. Actual size. Silver.

RHEIMS. [REIMS.]

RHEINPROVINZ. The province of the Rhine is sometimes called Rheinpreussen, or Rhenish Prussia, though this latter name is more generally understood to include the province of Westphalia. It lies between 49° 10′ and 51° 55′ N. lat., and between 5° 55′ and 8° E. long. It is situated on both sides of the Rhine, and comprises the grand-duchy of the Lower Rhine, and the duchies of Juliers, Cleves, and Berg. It was formerly divided into two provinces, the Upper and Lower Rhine. It contains the five governments of Cologne, Düsseldorf, Coblenz, Treves, and Aachen (Aix-la-Chapelle). Except the circle of Wetzlar, which is encompassed by Nassau, Hesse-Darmstadt, and Hesse-Cassel, it is bounded on the north by Westphalia, on the east by Nassau and Hesse-Darmstadt, on the south by France, and by the territories belonging to Bavaria, Saxe-Coburg, and Hesse-Homburg, on the left bank of the Rhine, and on the west by the grand-duchy of Luxemburg, Belgium, and the Netherlands. The area is 10,230 square miles, and the population 2,473,723 inhabitants, or nearly 242 to a square mile.

The northern, eastern, and southern parts of the province are mountainous.

The Hundsrücken, which extends between the Moselle, the Rhine, and the Nahe, forms the west side of the valley of the Rhine and the east side of the valley of the Moselle, and is connected on the south with the Vosges. Its highest point, within the province, is in the Soonwald, which is 2015 feet above the level of the sea.

The Eifel, which is a wild and partly very sterile chain, is a continuation of the Ardennes, and extends between Luxemburg, the Moselle, and the Rhine. In the eastern part there are numerous extinct volcanoes.

The Westerwald is a rude chain, which likewise shows many traces of volcanic action. The most interesting part of it is that called the Siebengebirge near Bonn; some parts of this chain are from 1200 to 1400 feet above the level of the sea.

The principal rivers are the Rhine, the Moselle, and the Lippe, which are navigable; the many smaller streams, most of which fall into the Rhine, are either not navigable or only by very small vessels. There are only two inconsiderable lakes in the province. The climate is temperate; the air on the right bank of the Rhine is pure and healthy; on the left side damp fogs are more frequent, especially in the north-west part, where there are many marshes; on the mountains it is cold. The natural productions of this province are equally numerous and valuable. The higher parts of the mountains are crowned with noble forests, and the declivities are covered with vineyards. The mineral kingdom yields silver, iron, copper, lead, calamine, marble, slate, freestone, millstones, basalt, porphyry, alum, manganese, sulphur, coals, and salt. Where the country slopes to the Rhine there are productive corn-fields and rich pastures; between the mountains there are fertile valleys, where flax, hemp, hops, and tobacco are grown, and fruit and garden produce of every kind are cultivated in great abundance. Game is plentiful, and all the domestic animals are bred in sufficient number.

But the great source of the prosperity of the province is the Rhine, which, from its junction with the Nahe to the village of Hochheim on its right bank, forms the natural boundary between the duchy of Nassau and the government of Coblenz; it then traverses the governments of Cologne and Düsseldorf, and leaves the Prussian territory at Schenkenschanz, opposite the Dutch village of Lobith, having passed through this province as an undivided stream for 150 miles. On the banks are many vestiges of Roman works and ruins of castles of the middle ages. The small rivers and streams are applied to turn mills and to work manufacturing machinery of every kind; for this, says Hassell, is the most industrious (*i.e.* manufacturing) province not only of the Prussian monarchy but of all Germany.

'It is perhaps not unsuitable,' says Nemnich, 'to call the duchy of Berg an England in miniature; we find in it a Manchester, a Leeds, a Sheffield, a Spitalfields, a Birmingham.' This was written above twenty years ago, and the comparison is now even more appropriate. [JULICH-CLEVE-BERG.] The trade of the province is very extensive. The numerous manufactures are particularly described in the articles on the several towns. [AIX-LA-CHAPELLE; BARMEN; DUSSELDORF; ELBERFELD, &c.] With regard to religion, about 1,830,000 are Roman Catholics, 610,000 Lutherans and Calvinists, 2600 Mennonites, and 30,000 Jews. There are 2345 Roman Catholic and 880 Protestant elementary schools, 49 mixed schools, and 59 Jewish schools.

(Dieterici, *Statistische Uebersicht*, &c., 1838; Hassell; Stein; Hörschelmann; *Weimar Almanach*, 1840; Schlieben, *Gemälde der Preussischen Monarchie*; Mayer, *Beiträge zur Statistik der Königlich-Preussischen Rheinlande*.)

RHEIN-HESSEN (that is, Rhenish Hesse) is one of the five provinces of the grand-duchy of Hesse Darmstadt. It is bounded on the north by Nassau, on the north-east and east by the province of Starkenburg (separated however from both by the Rhine), on the south and south-west by Bavaria, and on the west by Rhenish Prussia. It forms one connected whole; only two communes, Kastel and Kortheim, being on the right bank of the Rhine opposite to Mainz. The surface is undulating, alternating with hills, valleys, and small plains. It is a hilly but not a mountainous country; the Rochus, or Hesselsburg, near Bingen, is but a great hill, being only 725 Paris feet above the Rhine. Nearly four-fifths of the country are arable land, one twenty-fifth pasture, almost one-fifteenth vineyards, and less than one twenty-eighth forests. The principal rivers are the Rhine, the Main, and the Nahe, besides which there are several smaller streams that rise in the Vosges or in Mont Tonnerre. The soil is light, and on the bank of the Rhine sandy, but it is everywhere extremely fertile, and the climate is so mild that the country is sometimes called the Wonnegau (that is, the delicious valley). The natural productions are oats, spelt, barley, rye, and millet (of all which, notwithstanding the great population of the country, considerable quantities are exported), flax, tobacco, and potatoes in great abundance. The cultivation of fruit is very general; all the roads are bordered with fruit-trees. Some of the wines are of excellent quality; the quantity produced in ordinary years is very considerable. The forests do not yield sufficient timber for home consumption. Oxen, swine, and poultry are numerous; but there are scarcely any sheep; most of the oxen are employed in agriculture. There are only a few manufactures, which are chiefly of linen, cotton, and leather. The province has a very active and profitable export trade in its own productions, and a good transit and commission trade. The following statement is from the Weimar Almanac for 1840: 'Area 520 square miles. Population (census of 1838) 206,900; the annual increase is estimated at 7500. Religion (in 1832): Evangelical, 87,695; Roman Catholics, 93,764; Moravians, 871; Jews, 7307. Principal towns: BINGEN; MAINZ; WORMS.'

RHEINGAU, THE, is a valley six leagues in length and two leagues in breadth, in the duchy of Nassau, between the Rhine and the Höhe, and extending from Biberach to below Rudesheim. It is formed by the Rheingaugebirge, begins at the village of Nieder-Walluf below Mainz, and ends at the village of Lorrich. It contains about 20,000 inhabitants, and the principal town is Ellfeld. This valley is protected on the north by the Taunus chain of mountains, and is celebrated for its beauty and fertility, and especially as producing the finest Rhenish wines. With regard to the cultivation of the vine, it is divided into the upper and the lower districts, that is, the villages on the heights and those on the banks of the rivers. The strongest wines are produced on the highest eminences; the most wholesome in the middle region; the wines of the valley are not so soon fit for use. The best wines are the Nierenstein, the Johannisberg, the Rudesheim, and the Biberach. That of Hochheim (Hock) is generally reckoned among the wines of the Rheingau, though Hochheim is beyond the boundaries of the valley as above described. Much fruit is cultivated on the mountains. At a distance from the banks of the Rhine there are considerable forests.

RHENANUS, BEATUS, was born in 1485, at Schlettstadt in Alsace. His father, though originally a butcher of Rheinach (whence the name Rhenanus), was a man of considerable property, and gave his son the best education that could be had in those times. After the boy had finished his elementary education, his father sent him to Paris, where he studied philosophy and antient literature. From Paris he went to Strasburg and Basel, and in the latter place he formed an intimate friendship with Erasmus and Gelenius. During his residence at Paris he had been employed in the office of the learned printer H. Stephens, and he occupied himself in a similar manner in the printing establishment of Froben at Basel.

In 1520 his father died, and left him all his property; but although Rhenanus retired to Schlettstadt, he continued his favourite study of the antients with the same zeal; and in order not to be disturbed, he requested and obtained from the emperor Charles V. an exemption from all public offices. He had always objected to marrying, but at last his friends prevailed upon him, and at the advanced age of 61 he married. A few months afterwards he was attacked by a disease, from which he sought relief in the baths of Baden, but as they only increased his sufferings, he returned home, and on his way thither he died, at Strasburg, on the 20th of May, 1547. His body was carried to his native place, and buried there.

Rhenanus is chiefly celebrated as the editor of many antient authors, on whom he bestowed great care, with the view of giving a correct text. The following is a chronological list of most of his editions:—

'Quintus Curtius,' Basel, 1517; 'Maximus Tyrius,' Basel, 1519; 'Velleius Paterculus,' Basel, 1520 (this is the editio princeps of that historian); 'Tertulliani Opera,' Basel, 1521; 'Auctores Historiæ Ecclesiasticæ,' containing Eusebius, Pamphilus, Nicephorus, Theodoret, &c., 1523-25 (reprinted at Paris in 1541); 'Plinius, Historia Naturalis,' Basel, 1526; 'Procopius Cæsariensis, De Rebus Gothorum,' Basel, 1531; 'Tacitus,' Basel, 1533; reprinted in 1544; 'Livii Decades Tres,' Basel, 1535.

Among the original works of Rhenanus we may mention —'Præfatio in Marsilii Defensionem Pacis pro Ludovico IV. Imperatore, adversus iniquas Ecclesiasticorum Usurpationes,' Basel, 1522. This work was published under the assumed name of Licentius Euangelus, sacerdos. 'Illyrici provinciarum utrique Imperio cum Romano tum Constantinopolitano servientis Descriptio,' published at Paris in 1602, together with the 'Notitia dignitatum imperii Romani.' 'Rerum Germanicarum,' libri iii., Basel, 1531: this work has often been reprinted. The edition of Sturm (Basel, 1551) contains a good Life of Rhenanus. He also translated several works from the Greek into Latin, such as some works of S. Gregorius Nazianzenus, part of the writings of Origenes, in the edition of Erasmus, &c.

RHESCU'PORIS. [THRACE.]

RHESUS MONKEY, a species of *Simiadæ*, placed by Cuvier and others among the *Macaques*. [MACACUS.]

Description.—Greyish, with a yellowish tint on the head and rump, and sometimes over the whole back; face flesh-colour; tail reaching beyond the hough.

Locality, Bengal.

RHE'TICUS. The real name of this individual was George Joachim. He was born February 16, 1514, at Feldkirch, a small town situated a few miles south of Lake Constance, and was surnamed Rheticus from the circumstance of this part of the Tyrol having been antiently inhabited by the Rhæti. When twenty-three years old he was appointed professor of elementary mathematics in the university of Wittenberg, the higher chair being at that time filled by Reinhold; but after teaching there with some repute for about two years, he relinquished his appointment in order to become the disciple and assistant of Copernicus, whose doctrines he advocated with much zeal and personal risk. His letter to Schöner, entitled 'Narratio de Libris Revolutionum Copernici,' wherein he endeavoured to show that the rotation of the earth about the sun is not a mere probable hypothesis, as Copernicus had thought fit to announce it, but an incontestible truth, and asserts that if Aristotle himself were living, he would be the first to acknowledge his error, excited against him the ill-will of the leading advocates of the Ptolemaic system. This letter appeared in 1540, Dantzig, 4to.; was reprinted the following year at Basel, and appended to the work of Copernicus, 'De Revolutionibus,' Basel, 1566; and to Kepler's 'Prodromus Dissertat.,' Tübing., 1596. He resigned his professorship in 1541-2; and in the latter year were published his 'Orationes de Astronomia, Geographia, et Physica,' Nürnb. He subsequently visited different parts of Germany, taught for some time at Leipzig, and died of apoplexy at Cashau, in the north of Hungary, 4th December, 1576. (Zedler.)

Rheticus has left an indisputable proof of extraordinary industry and devotedness to science in a posthumous work, entitled 'Opus Palatinum de Triangulis à Georgio-Joachimo-Rhetico cœptum, L. Valentinus Otho, principis palatini Frederici IV., electoris mathematicus consummavit, Neostadii in Palatinatu,' 1596, fol. The least important part of this work is the introductory treatise on Trigonometry, in nine books, of which the first four, relating to right-angled triangles, were written by Rheticus, and the other five, on oblique triangles, by his pupil Otho. They comprise four hundred and eighty-one folio pages, which, observes Delambre, might be compressed into ten.

As authors, Delambre declares that Rheticus and Otho were the most prolix and obscure that he had ever met with. After the introductory treatise follows a table of sines, cosines, tangents, cotangents, secants, and cosecants, to every ten seconds of the quadrant, and to a radius of 10,000,000,000. Nearly the whole of this extensive table, which must have been of inestimable value to the astronomer, was the work of Rheticus, though the contrary might be inferred from the statements of Montucla and Lalande. The sines were originally computed by him to fifteen places of figures, and were correct to the fourteenth, as was shown by M. Prony, in the fifth volume of the 'Mémoires de l'Institut;' but only the first ten were inserted in the 'Opus Palatinum.' The table of tangents and secants was not quite complete when Rheticus died. Those which were wanting were added by Otho. The whole were computed to ten places of figures, of which only the first eight could be relied on. Pitiscus subsequently computed the tangents and secants as far as eleven places of figures (Montucla says sixteen), which, with the rest of the table of Rheticus, he published in 1613, under the title of 'Thesaurus Mathematicus.'

It is to the labours of Pitiscus that Montucla ascribes most praise, designating them 'the most remarkable monument of human patience, the more meritorious as it was accompanied by so little glory,' which, observes Delambre, would be true if the name of Rheticus were substituted for that of Pitiscus, whom he considers to have been little more than the editor of the 'Thesaurus Mathematicus.' (See the *Astronomie Moderne*, ii., p. 34.) The only terms employed in the 'Opus Palatinum' to express the several functions of an arc, are base, perpendicular, and hypothenuse; the terms tangent and secant had not then been introduced, and the appellation sine, which had been generally employed by Müller and others, was rejected by Rheticus. The construction of the canon is understood to have commenced in the year 1540.

Rheticus had intended to publish two treatises in German on astronomy and philosophy generally, and had announced a work on chemistry, in seven books, none of which have appeared. In these his chief aim was to abolish hypothesis, and to rest exclusively on observation.

(Zedler, *Grosses Universal Lexicon*, xiv. 812; Kästner, *Geschichte der Mathematik*, i. 561-2; Delambre, *Astron. Mod.*, ii. 1-25; Weiss, *Biog. Univ.*, art. 'Joachim;' see also Adani *Vit. Philos. Germ.*; and Vossius, *De Mathem.*)

RHETORIC (ῥητορική) is a Greek word of similar import to the Latin oratory; but a rhetorician is a teacher of or writer on oratory, and an orator is one who practises the art: Demosthenes was an orator, Aristotle was a rhetorician, and Cicero was both.

English writers, in treating of rhetoric, appear generally to consider it the same as oratory, and perhaps it is difficult to make a distinction between them. Cicero's 'Orator,' 'De Oratore,' and 'De Claris Oratoribus,' are always called rhetorical works. Quinctilian (*Inst.*, ii. 14) speaks of persons who translated the Greek word 'rhetorice' into Latin by 'oratoria' and 'oratrix;' but he objects to the use of both these words, and adopts the Greek word, which, he says, Cicero himself employed to designate certain books (probably the two books 'De Inventione') which he had written on this art. What Quinctilian calls 'rhetorice' is discussed at length under ORATORY, and an account of Quinctilian's work on the same subject will be found under QUINCTILIAN. In the former article it is stated that the treatise of Aristotle on rhetoric is the oldest extant treatise on this art, and one of the most valuable books preserved from antient times. The present article seems to furnish a suitable occasion for giving a short account of Aristotle's work.

Aristotle begins by saying that rhetoric is the counterpart (ἀντίστροφος) of logic, and he defines it to be the faculty (δύναμις) of perceiving on any given subject what is best adapted to persuade. He divides rhetoric into three parts: Persuasion (πίστις, or rather πίστεις), Language or Expression (λέξις), and Arrangement (τάξις). His work consists of three books, of which the first and second treat of persuasion, and the third treats of expression and arrangement.

After premising some general remarks on rhetoric, he treats of persuasion as derived from enthymemes (ἐνθυμήματα). Having stated that there are three kinds of persuasion, the deliberative (συμβουλευτικόν), the demonstrative (ἐπιδεικτικόν), and the judicial (δικανικόν), and that, in reference to each of these, persuasion is both special (ἴδιαι) and general (κοιναί), c. 3, he discusses the subject of special persuasion in each kind: touching the deliberative he inquires whether it be useful, c. 4 to 8; touching the demonstrative, whether it be honourable, c. 9; touching the judicial, whether it be just, c. 10 to 15. He concludes the first book by stating and explaining the modes of producing persuasion without the art of rhetoric, c. 16.

In the second book he proceeds to say that, in reference to certain questions, special persuasion must be considered as depending on the character of the speaker, c. 1; and on the passions of the hearers, c. 2 to 13; as also on the general character of the hearers, such as their passions, their moral habits, their different ages and conditions in life, c. 17 to 19. He closes the discussion of special persuasion by viewing it in connection with questions common to the three kinds of persuasion, such as possibility, fact, futurity, and magnitude, c. 19. He then proceeds to persuasion considered generally and indefinitely, of which he mentions two kinds, example (παράδειγμα) and enthymeme (ἐνθύμημα), adding *gnóme* (γνώμη) as included in enthymeme, c. 20 to 26.

He commences the third book with the second part of rhetoric, namely, expression. He states what is necessary to constitute expression, c. 2 to 4; and describes its various forms, c. 5 to 9. He treats of elegance (τὰ ἀστεῖα), c. 10, 11; and represents the different kinds of expression, c. 12.

He then comes to the third part of rhetoric, which is arrangement. This, he says, consists necessarily of two parts, the proposition of any subject, and its confirmation; but there may be four parts, introduction (προοίμιον), proposition (πρόθεσις), confirmation (πίστις), and peroration (ἐπίλογος). He concludes the work by discussing these four parts of arrangement: introduction c. 14, 15; proposition, c. 16; confirmation, c. 17; peroration, c. 19.

Aristotle's *Rhetoric* is not only the best treatise upon this subject, but a model of profound thinking and reasoning for the investigation of various other subjects.

RHEUM, a genus of plants of the natural family of Polygonaceæ, of which the name is taken from the ῥῆον of Dioscorides, and which includes the different species of plants which yield the stalks and root so well known by the name of rhubarb. It is doubted by some whether the root to which the name *rha* and *rheon* was applied by the Greeks was the same as that to which we now apply the name of rhubarb, because the descriptions of the former given by Dioscorides and Pliny do not apply to the latter. It is admitted however that our rhubarb was known to the later Greek physicians, as Alexander of Tralles and Paulus of Ægina, and there is no doubt that the Arabs were well acquainted with it; and it is remarkable that they quote *rheon* as the Greek synonyme of their *rawund*, which is rhubarb, and which they describe as being of various kinds, as Indian, Turkish, Chinese, and from Khorassan. From this it is probable that one kind may have become substituted for another as the communication with the East increased.

Long as rhubarb has been known, it is remarkable that the species of Rheum yielding it is yet unknown; this is in consequence of the best rhubarb, Turkey rhubarb, being only obtained by the Russians at Kiachta from the Chinese. That called Chinese may be the produce of the same, or of a different species, from the northern boundaries of that country. Dr. Royle, after reviewing the different accounts of the commerce of rhubarb, states:—'This would bring the rhubarb country within 95° of E. long., in 35° of N. latitude, that is, into the heart of Tibet. As no naturalist has visited this part, and neither seeds nor plants have been obtained thence, it is as yet unknown what species yields this rhubarb.' Sievers had previously said that his travels had satisfied him that as yet nobody, that is, no scientific person, has seen the true rhubarb plant. The Himalayan and Persian rhubarbs have alone been ascertained.

The different species of rhubarb are important plants, not only on account of the roots being so extensively employed, and so valuable for their medicinal qualities, but also on account of the stalks of the leaves being now so much employed, from their agreeable acidity, in making tarts, &c. As the species are all indigenous in cold parts of the world, that is, from the southern parts of Russia, Siberia, Tibet, the north of China, and the Himalayas, so they may all be grown in the open air of this country, and several are cultivated on account of their stalks. Some also, both in England and France, are cultivated on account of their roots, often for the purpose of adulteration. The genus Rheum is characterised by having an inferior petaloid sexpartite calyx, into the bottom of which the stamens, about nine in number, are inserted; anthers opening lengthwise; ovary superior, with a single erect ovule; styles three, reflexed; stigmas peltate, entire; fruit (achenium) three-cornered, winged, with the withered calyx at the base.

The species which are known and cultivated are the following:—

1. R. Emodi, Wallich, Australe of Don, is found in Kumaon; the root is a valuable medicine, though bearing hardly any resemblance to that of the shops. Stems much branched, 6 to 10 feet high, very thick below, gradually diminishing, and spreading into large panicles, and there rough, with minute warts. Leaves very large, cordate, acute, dull-green, but little wavy, very rough, covered with little hairs. Petioles very rough, furrowed, and very much narrower at the upper than the lower end. Panicles terminal, very long. Flowers blood-red, very small.

2. R. Webbianum, Royle, 'Illust.,' t. 99, Emodi of Meisner, found by Mr. Moorcroft at the height of 12,000 feet above the level of the sea, and by Dr. Royle on the Choor Mountain. Root-leaves large, long-stalked, rather downy above, veiny beneath, margin hairy. Axillary racemes clustered, terminal, panicled; pedicels in threes, twice as short as the ripe fruit.

3. R. spiciforme, Royle, 'Illust.,' t. 78, found on the northern face of the Himalayas. Leaves thick, leathery, cordate, blunt, red and netted beneath, and covered with stellate down on each side. Pedicels numerous, clustered, as long as the ripe fruit. The roots are lighter coloured and more compact than those of R. Emodi.

4. R. Moorcroftianum, Royle (Small-Stalked Rhubarb). Leaves and stems covered with short pubescence; petioles deeply furrowed; the stipules as long as the petioles, and very membranous; scales at the base yet longer, extremely thin, and, towards the summits, much torn. This species was found by Messrs. Moorcroft and Hearsay near the Niti Pass in the Himalayas, at an elevation of 12,000 feet.

5. R. leucorhizum, Pall. (nanum, Sievers; tataricum, Linn.). A small plant for the genus; the root is white and branched, though said to be equally efficacious with the best sorts. Radicle leaves about three, short stalked, from four to six inches long, and from five to nine broad; smooth on both sides, toothletted at the edge. Flowering stem about two inches high when in flower, afterwards becoming ten to twelve high.

6. R. rhaponticum, Linn. North of the Caspian. According to Guibour, cultivated largely near Lorient, in the department of Morbihan in France, at a place called from that circumstance Rheumpole. Leaves roundish, ovate, cordate, obtuse, but little wavy, very concave, even, very slightly downy on the under side. Panicles very compact and short, always rounded at the ends, and never lax. R. rhaponticum, hybridum compactum, and hybrid varieties of them, are the common garden rhubarbs, of which one is called R. hybridum.

7. R. undulatum, Linn. (rhabarbarum, Linn.). China and Siberia. Leaves oval, obtuse, deep green, with veins purple at the base, often shorter than the petiole, downy on each side 'when young, looking as if frosted. Petiole downy, blood-red, semi-cylindrical.

8. R. caspicum, Fischer (rhaponticum, Ledbour). In the Altai Mountains. Leaves ovate, acuminate, obtuse, cordate, inflexed at the base, thick, very wavy, glossy on the upper but slightly downy on the under side. Petiole pale green, minutely downy.

9. R. compactum, Linn. Tartary and China. Leaves heart-shaped, obtuse, very wavy, deep-green, thick, quite smooth on both sides, glossy on the upper. Sinus nearly closed with parenchyma. Petiole green.

10. R. crassivernium, Fischer. Leaves heart-shaped, acuminate, obtuse, wavy, bullate, deep green, quite smooth, rather glossy above, ribs slightly coloured red, the centre ones above half an inch deep at the base. Petiole dull red, rounded, rather angular.

11. R. palmatum, Linn., generally thought to be the source of the true officinal rhubarb. Near the great wall of China. Leaves roundish, cordate, half palmate; the lobes pinnatifid, acuminate, deep dull green, not wavy, but uneven and very much wrinkled on the upper side, hardly scabrous at the edge, downy on the under side. The flowering stems are taller than those of any other species.

12. R. Ribes, seems to be so named from the Persian name *ribas*, which is as frequently written *rewash*, and which Elphinstone, Burnes, and other travellers notice as being highly esteemed by the Persians, and of which the stalks are prepared in a variety of ways, and considered a great delicacy. For a fuller account of the localities, characters, &c. of these various species, see Royle's *Illustr. Himal. Bot.*; Lindley, *Flora Medica*; and Pereira, *Elements of Materia Medica*.

RHEUM (*Rhubarb*), MEDICAL PROPERTIES OF. As the particular species which yields the officinal rhubarb, and even the precise place of its growth, are not known, the varieties met with in commerce are here described, without attempting to assign them to any ascertained species. There are six well-marked varieties, viz. Russian or Turkey, Dutch-trimmed, Chinese, Himalayan, English, and French. Of the first sort the greater portion at present comes from St. Petersburg, and is denominated Muscovite, Bokharian, or Siberian rhubarb, while a 'part has always formed one of the imports from China into Bokhara, whence passing to Smyrna, it is known in Europe as Turkey rhubarb' (Royle, *Flora of the Himalaya*), which name it commonly bears in the shops. This kind varies much in size and appearance, the pieces being cylindrical, spherical, flat, or irregular, from two to three inches long, one to three broad, and one to three thick. 'The smaller pieces are picked out, being preferred, while the larger pieces and the dust are employed for powdering.' Holes are remarked in many of the pieces, of which one occasionally extends entirely through, the others only partially; the former having been made in order to suspend the piece in drying, the others in examining the quality. This kind, and probably the other sorts, is frequently worm-eaten, owing to the ravages of a small beatle, sinondendrum pusillum. (Kirby and Spence's *Entomology*, i., p. 252.)

Externally the pieces are covered with a bright yellow-coloured powder, which either results from the friction of the pieces during their passage to this country, or from the process of rouncing (that is, shaking in a bag with powdered rhubarb), previous to its exportation. The odour is strong, both of the root and fresh powder, peculiar, somewhat but not pleasantly aromatic. When chewed, it feels gritty, owing to the presence of numerous raphides (or crystals of oxalate of lime, which are present to the amount of between 30 and 40 per cent.); it communicates a bright yellow colour to the saliva, and has a bitter, slightly astringent taste, which to some persons is not unpleasant, as they are in the habit of chewing rhubarb to obtain its tonic effects on the stomach; but this practice is objectionable from the yellow colour it imparts to the teeth and gums.

When the dust which covers the surface is removed, it exhibits a more or less reddish-yellow hue with white lines interspersed, which form beautiful reticulations, best seen on a vertical section, while a transverse section exhibits small star-like spots and depressions of a darker colour. The transverse fracture is uneven, the longitudinal still more so. 'The powder of genuine Russian rhubarb is of a bright yellow colour, verging to red, but as met with in the shops it is almost invariably mixed with the powder of English rhubarb, which gives it a much lighter colour.

The analysis of this sort shows it to consist of—

Rhubarberine (or bitter principle of Pfaff)	16
Yellow colouring matter (of Henry)	9
Bitter extractive	14
Oxidized tannin	1
Mucilage	10
A substance extracted from the woody fibre	28
Oxalic acid	1
Woody fibre	14
Moisture, loss, odorous principle	3

The chief chemical distinction between this and English rhubarb is the presence in the latter of a principle termed *rhaponticin*, and 14 per cent. of starch, with a smaller portion of rhubarberin, of yellow colouring matter, and extractive: iodine furnishes a ready distinguishing test, for a 'decoction of Russian, Dutch-trimmed, or Chinese rhubarb becomes, with a solution of iodine, greenish-blue (iodide of starch); after a few minutes the colour disappears, and no iodine can be detected in the liquor by starch, unless nitric acid be previously added; a decoction of English rhubarb is rendered by a solution of iodine intensely blue (iodide of starch), the colour not completely disappearing by standing.' (Pereira.) This difference is clearly dependent on the much greater portion of starch existing in English rhubarb. Inferior rhubarb, or roots cut to resemble rhubarb, and sprinkled over with powdered turmeric, or dyed with it, may be detected by means of boracic acid, or any borates rendered acid, since the colour of genuine rhubarb, or paper dyed with it, is not affected by these re-agents, whereas turmeric-paper is reddened by them. Yellow ochre, with which black and worthless pieces are covered, or which is used to fill the holes in worm-eaten pieces, may be detected by heat, as it burns with a brownish red appearance, and exhibits the characters of a ferruginous earth.

Portions unusually white are occasionally found in the chests of Russian rhubarb, and are presumed to be specimens of *imperial rhubarb;* but nothing certain is known of its origin or relative value.

2. Dutch-trimmed rhubarb, called also by some writers Persian rhubarb, and Batavian, occurs in flat or round pieces, and is not much different in appearance from the preceding, but it reaches Europe through Canton and Singapore. It is said to be very liable to the attacks of a small coleopterous insect, Anobium boleti, and that the holes so made are stopped with yellow ochre.

3. Chinese or East Indian rhubarb, termed in commerce *half-trimmed or untrimmed* rhubarb, rarely presents an angular character, but occurs in rounds or flats. 'The best pieces are heavier and more compact than those of the Russian kind, and the odour is much less powerful and less aromatic.'

4. Himalayan rhubarb is not known as a commercial article in this country, nor is it even an article of large consumption in India, where it sells for only one-tenth of the best rhubarb, resembling in quality the Russian, and which is found in India. The finest Russian rhubarb might be introduced and cultivated in the territories of the East India Company, or, as Dr. Royle observes, 'a trade in rhubarb with Tibet or Western Mongolia might be established by means of the Tartars who resort to the hill fairs. This trade might easily be encouraged by the government purchasing all the rhubarb it requires, which might thus be employed for hospital use after crossing the frontiers, instead of, as now, after making a journey of 20,000 miles, or nearly the circuit of the globe.' (*Flora of the Himalaya.*)

5. English rhubarb occurs in two states, '*dressed or trimmed* so as to resemble the Russian kind, and *stick* rhubarb. The first is grown at Banbury in Oxfordshire, and is frequently used for the show-bottles in druggists' windows, and often sold in the streets of London for *Turkey rhubarb,* by persons dressed up as Turks. Stick rhubarb is sold in the herb shops, and is in long pieces.'

6. French rhubarb is not brought into this country.

What is termed *Monk's rhubarb* is not the produce of any species of *rheum,* but of the Rumex alpinus, which grows in Switzerland, Germany, and Mount Taurus, and is more astringent than purgative; it is mostly used by the monks of the Alps, or to adulterate the other sorts.

Large importations of rhubarb are made into this country, partly from Russia, but much more from the East Indies; but the greater part is for re-exportation. The quantity retained for home-consumption, and on which only a duty of one shilling per pound is paid, scarcely constitutes one-fourth of the entire amount.

Rhubarb presents the peculiarity of producing two opposite effects, according to the dose exhibited. In small doses it is tonic and astringent, in large doses purgative, but generally followed by constipation. It is moreover somewhat heating, and therefore unfit for the early stage of inflammatory diseases; on the other hand, its tonic properties render it eminently proper in the later stages of these diseases. In debility of the digestive organs, alone, or better in conjunction with other agents, it is a most valuable remedy; but it is very improper in the form of powder for very young children, as the insoluble woody fibre irritates their delicate stomachs, and contributes to produce that state of irritation under which so many young children sink who are overdosed with domestic medicines. Dr. Reid, from large experience at a public dispensary, stated it as his deliberate opinion, that half the children which died in London under two years of age were killed by mothers and nurses dosing them with rhubarb and magnesia. A more rational proceeding is to regulate the diet of tender infants, especially of such as are not suckled by the mother or a wet nurse; above all, to avoid giving them stimulating drinks or raw fruits.

Several species of rheum, and garden varieties of them, are cultivated for the sake of the petioles of the leaves, which are much used to make tarts in spring. The cooling and gently aperient properties of these render them grateful and beneficial to most persons; but individuals prone to calculous complaints should carefully avoid them, and all vegetables which owe their acidity to oxalic acid, as the formation of the oxalate of lime, or mulberry calculus, may be the consequence of indulgence. This observation applies equally to the species of Rumex which are used as sorrel. [CICER ARIETINUM.] (Pereira's *Mat. Med.*)

RHEUMATISM (from ῥευματισμὸς, 'a defluxion'). It is probable that this term was originally adopted during the prevalence of the doctrines of the humoral pathology, when every disease attended with swelling was attributed to the flow of some morbid humour to the part affected. Before the year 1642, rheumatism and gout were usually described as one disease, under the name of arthritis; the distinction between the two is said to have been first accurately made by Bellonius, a physician who suffered much from rheumatism. We shall first treat of articular rheumatism in its acute and chronic form, and then describe some of those affections which, from their greater resemblance to it than to any other disease, have been called rheumatic.

Acute rheumatism, called also rheumatic fever, has been so well described by Sydenham, that we make use of his own words: 'This disease,' he observes, 'happens at any time, but especially in autumn, and chiefly affects such as are in the prime of life. It is generally occasioned by exposing the body to the cold air immediately after having heated it by violent exercise or some other way. It begins with chilliness and shivering, which are soon succeeded by heat, restlessness, thirst, and the other concomitants of fever. In a day or two, and sometimes sooner, there arises an acute pain in some or other of the limbs, especially in the wrists, shoulders, knees; which shifting between whiles, affects these parts alternately, leaving a redness and swelling in the part last affected. In the beginning of the illness the fever and the above-mentioned symptoms do sometimes come together, but the fever goes off gradually, while the pain continues and sometimes increases.' Acute rheumatism varies considerably in intensity and duration; the patient may have considerable fever, and severe pain in nearly every joint, so as to render him perfectly helpless; or the fever may be slight, and the local inflammation limited to one or two joints. There is not always a relation between the severity of the local symptoms and the constitutional disturbance. The duration of this disease depends on the mode of treatment; it may be terminated in a few days, or may endure as many months; in nearly every case the general symptoms cease before the local inflammation is stopped. Acute rheumatism simply, is seldom if ever a fatal disease, but complicated with pericarditis, endocarditis, or pleurisy it is highly dangerous. It behoves us therefore in every case of rheumatism to be on our guard against these complications; they are so frequent and come on so insidiously, that a recourse to the aid of the stethescope should never be neglected. With respect to what is called chronic rheumatism, it may be either a continuance of acute rheumatism in a milder form, or may originate in this chronic, or, more properly speaking, subacute character. In either case all the characters of acute rheumatism are present; but in a less violent degree; thus, there is a quickened pulse, some increased heat of skin, a furred tongue, and loss of appetite and sleep, the febrile action undermines the general health, while the local inflammation, although indolent, disorganises the joints. This state of things may endure for an indefinite period, or the febrile symptoms may after a time disappear and the morbid action in the joints cease, not however without leaving behind them such ravages as require a special local treatment. Dr. Elliotson has distinguished chronic rheumatism into hot and cold: in the former, the joints affected are above the natural temperature of the other parts of the body, and are relieved by the application of cold; in the latter, the contrary is the case. Whether the pain of the joints is relieved most by hot or by cold applications, it is generally aggravated in cold moist weather, and diminished during an opposite condition of the atmosphere. The only diseases with which rheumatism can be confounded are gout and periostitis: for its distinction from the former of which see GOUT. The term rheumatic, whether properly or not, has been applied to various affections which have very little resemblance to one another, except in being attended with pain; rheumatic gout however is as significant and appropriate a name as could have been devised. It is a disease partaking so strongly of the characters both of gout and rheumatism, that it is impossible to say to which of them it belongs; it may be rheumatism attacking also the small joints, or it may be gout extending to the large; in either case the distinction is not of much importance, as the treatment is the same. When rheumatism is seated in the back, it is called lumbago, from 'lumbus,' the loin; when in the back of the neck, the patient is said to have a stiff neck, or a 'crick in the neck;' when in the head, one half only is usually attacked, and it is called hemicrania. When the pain occupies the more fleshy parts of the limbs, as the muscles or their aponeuroses, the term rheumatalgia is sometimes made use off. In this last-named affection there is neither redness nor swelling, and pain is experienced only when the muscles of the part affected are called into action. Many persons believe that the nerves themselves may be affected with rheumatism, and refer to sciatica and hemicrania as examples. In these cases the pain is generally of an intermittent character; but Dr. Elliotson is of opinion that this intermittence of pain is not peculiar to nervous rheumatism, but is met with also when the aponeuroses of muscles are the seat of the disease, which he believes to be the case in hemicrania. He thus describes hemicrania: 'It usually attacks one half of the organ (the head), and the pain generally comes on in the evening about six o'clock and continues very violently for a few hours. Occasionally when it is intermittent in this way, the parts are hot, swollen, and throb, and the eyes water, but in other cases this is not felt.' Many physicians of eminence deny that the above-named affections are rheumatic, and consider them to be of nervous origin; hemicrania and lumbago they call neuralgia, and rheumatalgia they designate by the term myositis. From this contrariety of opinion we may conclude that little is known respecting the structures actually affected in these varieties of rheumatism; of the morbid changes which they undergo we are likewise in equal ignorance. In the true or articular rheumatism it is the synovial membrane lining the cavity of the joints and the fibrous tissues external to them that principally suffer. The respective degree in which each of these structures is implicated, is not the same in every case. Thus, in one case we shall find the joints distended with fluid, the fluctuation of which is very perceptible to the hand; while in another there shall be swelling, but it will be more diffused and without fluctuation, showing that little or no effusion has taken place into the joint, but that the swelling results from the inflammation of parts external to it. This difference has led some persons to speak of rheumatism as fibrous and synovial, but inasmuch as it is not always easy to determine to which variety the case under examination may belong, and is besides of no practical importance, the distinction is not usually regarded. The fluid which is found in the joints may be either gelatinous or purulent, according to the severity of the inflammation. The synovial membranes which line them are red and thickened; the ligaments external to the joints are thickened and rigid, the limbs frequently contracted, and the muscles wasted. In rheumatic-gout there is often found a deposit of lithate of soda in the joints affected, a proof that, in many cases at least, this disease partakes more of the character of gout than of rheumatism. The appearances presented in the heart and its coverings, where this organ has been attacked, have already been described in the article HEART, DISEASES OF.

Causes of Rheumatism.—Among the causes which predispose to rheumatism must be placed an hereditary tendency and the age and temperament of the individual. The period of life most subject to acute rheumatism is from puberty to 35 years of age, and persons of full plethoric habit are said to be more liable to its attacks than those of an opposite temperament. It is supposed by many among whom may be cited the names of M. Andral (*Anatomie Pathologique*), M. C. Roche (*Dictionnaire de Médécine et de Chirurgie*), and Dr. Barlow (*Cyclopædia of Practical Medicine*), that an absolute or relative condition of plethora is essential to the development of rheumatism; and the blood, according to these authorities, may be either excessive in quantity or altered in quality. 'There are some individuals,' observes M. Andral, 'who naturally make a greater quantity of blood than others. When the blood-vessels contain a greater proportion of the nutritive fluid than is necessary to supply the demands of the different organs, the superabundant quantity becomes a permanent source of excitation to the solids, and at the same time the blood has a remarkable tendency to accumulate in different organs; so that in such a case the whole system is in a general state of excitation, and some of the organs may become the seat of local congestion of various degrees of duration and intensity.' In applying these doctrines to the disease we are considering, he observes, 'If we mark the symptoms and progress of acute rheumatism, we find that very often a well-marked febrile action, with a strong reaction, but without any symptom whatever of local affection, precedes the pain. In a word, there is first an inflammatory fever, and then rheumatism. Next observe the extreme mobility of the rheumatic pains. They run along, in a manner, wherever the blood is distributed; the application of leeches often removes the pain from one part, but it soon shifts to another, and not unfrequently it quits the articulating tissues and fixes on different internal organs, producing, by the derangement of their functions, symptoms more or less severe. It often happens that bleeding from a large orifice puts an end to the disease, as if, by diminishing the mass of blood, it proportionally diminished the stimulus that promoted all these shifting irritations.' It is then, when the body is in this predisposed condition, from any of the before-mentioned causes, that exposure to a continued draught of cold air or a shower of rain becomes the immediate exciting cause of an attack of rheumatism. There can be no doubt however that, besides this condition of plethora, which predisposes to disease generally, there must be a more specific predisposition to the particular disease we are treating of before rheumatism can be produced. Cold may be a cause, and so may be anything else that suddenly disturbes the balance of the circulation; but why the same agent should produce rheumatism in one case, bronchitis in another, pneumonia in a third, and so on, can only be explained by supposing that each individual has some particular organ or organs which are more prone to disease than other parts of his organization.

The treatment of rheumatism must chiefly have reference to the constitutional nature of the disease. Nearly all physicians, from Sydenham downwards, have concurred in the propriety of general blood-letting, the quantity of blood to be drawn depending upon the severity of the attack, the age and constitution of the patient, and the impression produced by this operation upon the disease. The celebrated physician just named was in the habit of taking blood to the amount of ten or twelve ounces, and repeating the evacuation every twenty-four or forty-eight hours, till the disease was subdued; bread and water poultices were applied to the inflamed joints, and abstinence from all stimulating food and fermented liquors was strictly enjoined. In St. Bartholomew's Hospital, phlebotomy to the extent recommended by Sydenham is seldom practised in acute rheumatism, Dr. Latham having observed that the disease is frequently not bettered by the operation, although the patient is considerably weakened.

This eminent physician is in the habit of prescribing a large dose of calomel, as ten grains, in the acute stage of the disorder, and if in twenty-four hours the amelioration is not decided, another similar dose is given; from personal observation of the effects of this treatment, we can pronounce it to be most successful. When the membranes of the heart are affected, local bleeding by leeches or cupping is resorted to, and the patient is brought under the influence of mercury. According to Dr. Elliotson, whether rheumatism be acute or chronic, the treatment should be exactly the same: 'You have only to make two distinctions,—to ascertain whether it is the inflammatory form of the disease: whether the parts are hotter than they should be, and heat does harm; or whether the parts are cooler than they should be, and heat does good.' In the one case he recommends antiphlogistic measures, and in the other stimulants; under the antiphlogistic measures, he comprehends bleeding and the administration of colchicum, the latter to be continued till it purges the patient. During the whole time of the treatment cold lotions are applied to the inflamed joints. In the chronic form of rheumatism the joints are kept hot with flannels and rubbed with stimulating ointments and liniments, while the ammoniated tincture of guaiacum, beginning with half-dram doses, is given three times a day. Dr. Elliotson also considers that mercury is occasionally useful in both kinds of rheumatism. Lumbago and sciatica are most successfully treated by cupping the loins and the parts over the course of the great sciatic nerve, followed by the application of blisters to the same regions, and a general antiphlogistic regimen. In hemicrania great relief is frequently obtained by the application of heat to the part affected, as in wrapping up the head in flannel. Should the pain evince a tendency to return every evening, a large dose of a narcotic should be administered just previous to the paroxysm, and if not relieved in two or three hours, a similar dose must be repeated; we are informed that one grain of stramonium for an adult frequently acts like a charm in this affection. In rheumatalgia, when the parts are not hot, and the pain is not increased by heat, acupuncture and shampooing have been found of great service.

Where the joints are stiff and contracted, from long-continued inflammation, warm bathing, combined with frequent and persevering exercise of them, have been attended with the most signal success.

(Sydenham, *Opera Medica*, 'Tractatus de Podagra et Hydrope;' Andral, *Anatomie Pathologique;* C. Roche, *Dictionnaire de Médécine et de Chirurgie;* Dr. Barlow, *Cyclopædia of Practical Medicine;* Dr. Elliotson, *Practice of Medicine.*)

RHIA'NUS, a Greek poet, was a native of Bena in Crete, and lived about the time of Eratosthenes. He was originally a slave who had a kind of superintendence over a palæstra, but he subsequently became a learned grammarian, and wrote several poems: one of them was a Ἡράκλεια, consisting of four books. (Suidas, v. Ῥιανός; Athen., iii., p. 82.) Another of his poems, called Μεσσηνιακά, contained a poetical description of the second Messenian war, of which we probably possess the substance in the account given by Pausanias in his fourth book. (See especially c. 6; comp. Müller, 'Dor.,' i. 7, 9.) Other poems of Rhianus were the Θεσσαλικά, Ἀχαικά, and Ἠλιακά. Athenaeus (xi., p. 499) also mentions epigrams of Rhianus.

The emperor Tiberius is said to have been very fond of the poems of Rhianus, and even to have imitated them. (Sueton., *Tiber.*, c. 70.) The few extant fragments of his works are collected in Brunck's 'Analecta,' in Jacob's 'Anthologia Græca,' in Gaisford's 'Poet. Græci Minor,' and separately in a little book by N. Saal, under the title 'Rhiani quæ supersunt,' Bonn., 1831. Compare A. Meineke's essay, 'Ueber den Dichter Rhianos,' in the 'Transactions of the Berlin Academy,' 1834.

RHIN BAS, a department of France on the eastern frontier, taking its name from the river Rhine (in French, Rhin), on the bank of which it lies. It is bounded on the north by the department of Moselle and the Rhenish portion of the kingdom of Bavaria; on the east by the grand-duchy of Baden, from which it is separated by the Rhine; on the south by the department of Haut Rhin; on the south-west by the department of Vosges; and on the west by that of Meurthe. Its form approximates to an oblong square or a parallelogram, extending from south by west to north by east along the Rhine, with a projecting portion on the north-west side extending westward across the chain of the Vosges. The greatest length is, from south-south-east to north-north-west, from the bank of the Rhine above Marckolsheim to the bank of the Sarre, above Sarreguemines, 68 miles, or along the bank of the Rhine from the same point to the neighbourhood of Lauterbourg, which is about the same distance. The greatest breadth is in the northern part, from the neighbourhood of Lauterbourg across the Vosges to the neighbourhood of Harskirch, 60 miles. The ordinary breadth however does not exceed 30 miles. The area is estimated at 1800 square miles, being scarcely equal to three-fourths of the average area of the French departments, and being rather greater than the area of the English county of Lancaster (1766 square miles), or rather less than that of Northumberland (1870 square miles). The population in 1831 was 540,213; in 1836 it was 561,851, showing an increase in five years of 21,638, or just about 4 per cent., and giving 312 inhabitants to a square mile. In amount of population it far exceeds the average of the French departments; in density of population it exceeds the average in the proportion of two to one. In both respects it very far exceeds Northumberland, but falls very far short of Lancashire. Strasburg, the capital, is a very short distance from the left bank of the Rhine, on the Ill, a small feeder of that river; 243 miles in a direct line east of Paris, or 294 miles by the road through Meaux, Châteaux Thierry, Châlons-sur-Marne, Vitry, Bar-le-Duc, Toul, Nancy, Lunéville, and Phalsbourg: in 48° 35′ N. lat. and 7° 47′ E. long.

Surface; Geological Character; Hydrography.—The principal ridge of the Vosges is just beyond the western boundary, so that the western side of the department is occupied by the rugged highlands, covered with wood, which form the eastern face of that chain. The projection at the north-western side of the department crosses the ridge in one part so as to include both the ridge itself and the western face down to the valley of the Sarre. The mountain sides are diversified with precipitous rocks, and picturesque valleys watered by small streams, which flow ultimately into the Rhine, except a few which join the Sarre. The mountains are composed of sandstones, limestones, and marls, comprehended in the saliferous group of formations. The lowest member of the group is a coarse red-sandstone (*grès des Vosges*), bearing a close resemblance to the old red-sandstone conglomerate of Monmouthshire, and containing abundance of quartz pebbles, apparently derived from the ruins of the primary rocks which form the nucleus of the Vosges. The upper part of this formation is finer grained, so as to bear a close resemblance to the variegated red-sandstone (*grès bigarré*), extremely similar to the new red-sandstone of England, which rests immediately upon it. Upon this rests the muschelkalk, a light grey or smoke-coloured limestone, with partings of marl; and upon this rest the variegated marles (*marnes irisées*), which are occasionally interstratified with gypsum or limestone. By convulsions subsequent to the deposition of the grès des Vosges, a portion of that formation has been thrown up into bold craggy mountains, while the later formations rest upon the lower portions, several hundred feet below, at the foot of the escarpment.

From the eastern foot of the Vosges, a rich tract forming part of the valley of the Rhine extends to the bank of that river. This part is occupied by the tertiary formations. The immediate banks of the river are in many places marshy.

A very small quantity of coal is procured. There are three iron-works, in which are three forges for producing pig-iron, and eleven forges for the manufacture of wrought-iron. Charcoal is the fuel principally used.

The department belongs entirely to the basin of the Rhine. The greater part is included in the valley watered by that river, and the remaining part, which extends across the Vosges, is drained by the Sarre, which falls into the Moselle, and so ultimately into the Rhine. The Rhine skirts the eastern boundary of the department; it is in this part about as broad as the Thames at London, but the great number of small islands of sand or gravel which occur in its course are very injurious to the navigation, which is carried on by boats of from 20 to 25 tons. These islands are generally wooded. The Rhine yields abundance of fish, especially trout, perch, salmon, carp, sturgeons, and eels. Some particles of gold are brought down by the current.

The principal feeder of the Rhine is the Ill, which rises in the adjacent department of Haut Rhin, near the Swiss frontier, and flows northward, its course being for the most part parallel to the Rhine and a few miles west of it, so that it receives the mountain-streams which flow down the eastern slopes of the Vosges, and thus becomes a considerable river. Nearly 40 miles of its course are in this department, and through the whole of that distance it is navigable. It receives the Liepvrelle, the Scheer, the Andlau, the Eger, the Bruche, into which flows the Mossig, all from the Vosges; passes Schelestat, Benfelden, Erstein, and Strasburg; and joins the Rhine a few miles below the last-named place. It is used for the conveyance of the timber of the Vosges and the other productions of the country. One or two arms of this river branch off from it above Strasburg, and communicate with the Rhine.

The Zorn, which receives the Zintzel; the Moder, which receives another Zintzel; the Surbach, which receives the Ebèrbach; the Seltzbach; and the Lauter, all flow from the eastern face of the Vosges into the Rhine. The Surbach and the Lauter rise in the Bavarian territory, and the Lauter has its course on the frontier of France and Bavaria, which it separates from each other. The Moder and the Lauter, the longest of these streams, have each a course of about 45 miles; the Moder alone is navigable, and that for only 2 miles. The others are used for floating timber down from the mountains to the low country or to the Rhine.

The course of the Sarre within the department may be estimated at about 20 miles, for nearly 10 of which it is navigable.

There are two navigable canals. The most important is the great canal for joining the Rhône and the Rhine, formerly called Canal de Monsieur. This canal enters the department on the south side from the adjacent department of Haut Rhin, and, running northward along the valley of the Rhine, opens into the Ill just above Strasburg. The canal of the Bruche commences near the junction of the Mossig and the Bruche, and follows the valley of the latter river till its junction with the Ill just above Strasburg.

The official statement of the inland navigation of the department, in 1837, was as follows:—

	Miles.
Navigation of the Rhine . . .	90
„ Ill . . .	51
„ Moder . . .	2
	143
Canal from the Rhône to the Rhine	33
Canal of the Bruche . .	13
	46

The number of Routes Royales, or government roads, on the 1st January, 1837, was seven; having an aggregate length of 206 miles, viz. 201 miles in good repair, and 5 miles out of repair. The principal road is that from Paris to Strasburg, which enters the department after passing Phalsburg (department of Meurthe), and passes through Saverne and Wasselonne. From Strasburg this road is continued across the bridge of Kell or Kehl on the Rhine into Germany. The road from Paris by Lunéville and St. Dié to Schelestat enters the department a short distance from the last-named town. A road from Colmar follows the course of the Ill, passing near Schelestat and through Benfelden to Strasburg; and another road from Neuf-Brisach follows the course of the Rhine, through Marckolsheim, to the same town. Two roads from Strasburg run northward along the valley of the Rhine to one near the river through Drusenheim, Beinheim, Seltz, and Lauterburg to Speyer (Spire) and Mayenz (Ments or Mayence) in Germany; the other, nearer the mountains, through Brumath, Haguenau, Soultz-sous-Forêts, and Weissemburg to Landau and Mainz. A government road crosses the Vosges from Haguenau to the small fortress of Bitche in the department of Moselle. The Routes Départmentales, or departmental roads, had at the same time an aggregate length of 390 miles; viz. 345 miles in good repair, 36 miles out of repair, and 9 miles unfinished. The bye roads and paths have an aggregate length of more than 4500 miles.

Soil, Agriculture, &c.—The soil of the mountains is rocky, and in great degree barren; that of the immediate bank of the river is marshy, but the flat which occupies the intervening space is rich and highly cultivated. About 450,000 acres, two-fifths of the whole area of the department, are under the plough. The produce in wheat is a trifle more than the average produce of the departments of France; but, from the density of the population, it is inadequate to the consumption of the inhabitants. The produce in rye, maslin or mixed corn (wheat and rye), and maize, is about half the average produce of the departments; and the produce in potatoes twice as great as the average. In oats the produce is small, and of barley and buckwheat scarcely any is grown.

Tobacco has been cultivated for two centuries, and, in some soils, is included with wheat and barley in a triennial rotation of crops. As early as the year 1718, the yearly produce of tobacco was about 80,000 cwts. Madder was introduced in the reign of the emperor Charles V., and is now so successfully cultivated, that the madder of Alsace has a preference in the Swiss, French, and English markets. The oleaginous seeds are grown, especially the poppy and the rape, the oil of which is used for domestic purposes in Alsace, Flanders, and Artois, in place of olive-oil. Hemp, which is much prized for cordage for vessels, is grown near Strasburg. There are several hop-gardens about Haguenau, the produce of which is sent over into Germany, and thence re-imported into France as of German growth, the reputation of the German hops causing them to fetch a higher price. The agriculture of the department is however susceptible of much improvement; the agricultural implements are clumsy, except in the neighbourhood of Strasburg; and there are many articles of produce which deserve more extensive cultivation than they now receive.

The meadows comprehend about 140,000 acres, and the commons and open pastures are 50,000 more. The number of horses is nearly twice as great as the average of the departments: they are of a good breed: both oxen and horses are employed in agriculture. The number of cows and heifers far exceeds the average of the departments; but that of oxen and bulls is less than half the average. The number of sheep is comparatively small. There are swine and poultry, especially geese, whose livers are used in making the pies for which Strasburg is famous. The vineyards comprehend 30,000 acres: very little red wine is produced: the best white wines are those of Molsheim and Wolxheim; those of Mutzig, Neuviller, and other places are wines of the second class. The orchards and gardens cover about 15,000 acres. The woodlands are very extensive, amounting to nearly 300,000 acres. A considerable part of the timber is formed into small rafts, and floated down the Rhine to Mainz, where they are united, so as to constitute enormous rafts from 250 to 300 yards long, and 25 to 30 yards broad, conducted each by 300 or 400 men. A part of the timber is sawn into deals and planks in Holland. The abundance of timber supplies not only sufficient fuel for domestic purposes, but also furnishes some for manufactures. It is not however sufficient for the demand, and a considerable quantity of coal is imported to make up the deficiency of wood.

Divisions, Towns, &c.—The department is divided into four arrondissements, as follows:—

Name and Situation.		Area in Sq. Miles.	Population.		Communes.	Cantons.
			1831.	1836.		
Strasburg	East & Central	546	205,029	218,839	162	12
Saverne . .	W.	506	108,112	112,260	165	7
Schelestat .	S.	444	131,295	134,887	114	8
Weissemburg	N.	304	95,777	95,873	103	6
		1800	540,213	561,859	544	33

In the arrondissement of Strasburg are—Strasburg, population in 1826, 49,708; in 1831, 49,712; in 1836, 57,885 [STRASBURG], on the Ill; Molsheim, pop. 3225; Mutzig, pop. 3551; and Dachtein, or Dachstein, on the Bruche; Wasselonne, pop. 3649 town, 4191 whole commune; Wangen or Vangen, and Westhoffen, pop. 2363; all on or near the Mossig; Brumath, pop. 3977 town, 4062 whole commune, on the Zorn; and Haguenau, pop. 8280 town, 9697 whole commune; Bischwiller, pop. 5927 [BISCHWILLER], and Drusenheim; all on the Moder, the last at its junction with the Rhine. Molsheim, or Moltzen, is in a wine-growing district at the eastern foot of the Vosges: it is a tolerably well-built town. The townsmen manufacture heavy iron goods, tools, cutlery and other hardwares, and paper; weave cottons and coarse linens; and trade in corn and wine. The manufacture of hardware was introduced in 1817, and workmen were engaged from the grand-duchy of Berg. Mutzig is in a valley near the foot of the Vosges: some of the townsmen are engaged in a government manufactory of fire-arms. Wasselonne has manufactures of woollen yarn, woollen hose, paper, and leather: there are bleach-grounds for linen. Two fairs are held in the year. There are extensive quarries near the town of freestone for building, and of a stone which approaches to marble in its susceptibility of polish. Pottery is made at Westhoffen. Brumath was known to the Romans by the name of Brucomagus, or Brocomagus: it is mentioned by Ptolemy and Ammianus Marcellinus, and in the Itinerary of Antoninus: the medals, sculptured stones, and urns, which have been found abundantly, show that the Romans were fixed here. It was the scene of conflict between the Imperialists and the French in the year 1793. Haguenau was founded by the emperor Frederick Barbarossa, and was one of the Imperial cities of Alsace: its privileges were abolished after the conquest of Alsace by Louis XIV. In 1675 and 1705 it was besieged by the Imperialists: in the second siege they were successful, but the town was retaken by the French soon after. In 1793 the Imperialists and Prussians were defeated near the town by the French, who carried their lines and entered the town. Haguenau is surrounded by old walls, strengthened by towers and a ditch. It has manufactures of cotton yarn and calico; and of woollen cloth, cordage, soap, pitch, tiles, pottery, and earthenware. There are several oil-mills, plaster-mills, madder-mills (a great quantity of madder is grown round the town), tan-yards, and breweries. There are four yearly fairs for cattle and general merchandise. The town has five churches and a Jews' synagogue: a college or high school, a military hospital, and a house of correction for women. Drusenheim, or Druzenheim, is fortified, there is a wooden bridge over the Zorn near the town. There is one yearly fair for hardwares, woollen cloths, and silks.

In the arrondissement of Saverne are Saverne, pop. in 1831, 5106; in 1836, 5352; and Hocfelden or Hochfelden, pop. 2253, on the Zorn; Marmoutier, pop. 2450 town, 2735 whole commune, between the Zorn and the Mossig; Neuwiller, near the Zintzel, which flows into the Zorn; Bouxwiller, pop. 3756, and Petite-Pierre, between the Zintzel (tributary of the Zorn) and the Moder; Ingwiller, pop. 2071, and Pfaffenhofen, on the Moder; Lichtemberg, between the Moder and its tributary the Zintzel; and Saar-Union, pop. 3531, Saarwerden, and Harskirch, on or near the Sarre, in the country west of the Vosges. Saverne was a post of some importance in the time of the Romans, who called it Tabernae. Julian, while he held the command of Gaul, repaired the place and strengthened it, in order to prevent the Germans, with whom he was at war, from penetrating into the interior. It belonged in the middle ages successively to the bishops of Metz and Strasburg, and was counted to be a place of strength; but in the Thirty Years' War, and in that which preceded the peace of Nimeguen, it was repeatedly taken and retaken: the fortifications were razed in 1697. The town stands on the Zorn, at the eastern foot of a steep and high mountain, one of the Vosges. The chief building is the former palace of the bishops of Strasburg, who used to spend their summers here. The townsmen manufacture hardwares, hosiery, and leather; and there are some breweries. The surrounding district is fertile in corn, wine, and pasture: considerable trade is carried on in wood, which is floated down the river. There are three yearly fairs. Saverne has a subordinate court of justice, some fiscal government offices, a college or high school, and an hospital. Marmoutier is a tolerably well-built town, surrounded by an old wall. The townsmen manufacture pottery, tiles, and bricks; there are breweries and bleach houses or bleach-grounds for linen; and a considerable trade in cattle is carried on. Bouxwiller is a busy place: the townsmen are engaged in weaving fustians, linens, and other goods, and in manufacturing hats: they have drying-houses for madder, bleach-grounds, and breweries. There are large works for making vitriol, sulphuric acid, ammonia, and other chemical preparations. There are three yearly fairs. Petite-Pierre is a place of strength amid the defiles of the Vosges: some hosiery is manufactured. Ingwiller has manufactures of madder, potash, starch, soap, snuff, cordage, and hosiery. There are dye-houses and bleach-grounds: there are three yearly fairs for corn and cattle. Lichtemberg is situated adjacent to the glacis of a small fort placed on a height in the midst of a wood. Saar-Union, or Sarre-Union, is divided by the Sarre into two parts: Bouquenom, on the right bank, and Neuf Saarwerden, or Sarrewerden, on the left. There are manufactures of cotton goods, embroidery, leather, and glass; also some dye-houses. The town has a college or high school. The remains of an old castle may yet be seen. Saarwerden, or Sarrewerden, distinguished as Vieux (old) Saarwerden, is so near to Saar-Union, as almost to form a suburb of it, but must not be confounded with Neuf-Saarwerden, which is an integral part of that town. Harskirch has some manufactures of worsted stockings and other woollen fabrics, soap, potash, and tiles: there are some dye-houses and a copper-foundry.

In the arrondissement of Schelestat are Schelestat, pop. in 1826, 9600 commune; in 1831, 9384 town, or 9646 commune; in 1836, 9700 commune [SCHELESTAT]; Benfelden, and Erstein, pop. 3472 town, 3613 whole commune, on the Ill; Marckolsheim, pop. 2265 town, 2344 whole commune, and Rhinau, on or near the Rhine; Châtenois, pop. 3318 town, 3867 whole commune, on the Liepvrelle; Villé and Dambach, pop. 3454 town, 3507 whole commune, on the Scheer; Andlau and Barr, pop. 3720 town, 4514 whole commune [BARR], on the Andlau or its tributaries; Bersh Obernai, pop. 4634 town, 4795 whole commune, and Niedernai, on or near the Eger; and Rosheim, pop. 3683 town, 3772 whole commune, between Obernai and Molsheim. At Benfelden considerable business is done in the tobacco and hemp grown round the town. At Erstein, cotton hosiery, snuff, cordage, tiles, and pottery are made; and there are dye-houses and bleach-houses or grounds for linen: two fairs are held in the year. Marckolsheim has manufactures of linen, breweries, potteries, tile and brick yards. Trade is carried on in hemp and tobacco. Muslins, calicos, coarse linen for wrappers, and paper, are made at Châtenois; and leather, tiles, and hosiery at Villé, where there are also bleach-grounds for linen. At Ober-nai there are copper-works. This town and Nieder-nai are sometimes called respectively Ober and Nieder Ehnheim. At Rosheim, woollen and cotton hose are made, cotton woven, and linen bleached. There are two yearly fairs.

In the arrondissement of Weissemburg are Weissemburg, pop. in 1826, 6146; in 1831, 6097; and in 1836, 5575; and Lauterbourg, pop. 2649, on the Lauter: Soultz-sous-Forêts, pop. 1968; and Seltz, pop. 2183 town, 2263 whole commune, on the Seltzbach; Warth, and Beinheim, pop. 1545, on the Surbach; and Reichshoffen, pop. 2536 town, 2661 whole commune, on the Zintzel, which joins the Moder. Weissemburg, or Wissemburg, is a fortress of considerable strength, and is connected with the 'lines' of Weissemburg, works constructed along the bank of the Lauter to cover this part of France. It was a free imperial town, and was dismantled by Louis XIV., when ceded to him by the peace of Ryswick: its fortifications have however been since reconstructed. It was taken by the Austrians in 1744 and 1793, but was each time retaken. There are several government offices, a Catholic and a Lutheran church, a Jews' synagogue, a college, and an almshouse. Hosiery, straw hats, earthenware, pottery, soap, and leather are made; and there are breweries. Lauterburg is also fortified: it has two churches, a synagogue, two hospitals (one of them a military hospital), ropewalks, breweries, and potash manufactories. At Soultz-sous-Forêts, pottery and pitch are made; the neighbourhood yields good wine, and there is a brine-spring near the town. Seltz is celebrated for its mineral waters, of which 30,000 bottles are sent yearly to different parts. At Reichshoffen are iron-works and a paper-mill. Much madder is grown round the town. At Niederbronn near Reichshoffen are iron-works and paper-mills; also some mineral springs.

The population given above, when not otherwise described, is that of the whole commune, and from the census of 1831.

The department is one of the most industrious in France; the principal manufactures have been noticed in describing the towns. The inhabitants are chiefly of German origin and speak a corrupt German dialect, except in the towns, where French is spoken. The majority are Protestants, either of the Lutheran or Reformed churches; and Strasburg is one of the chief places of education for the Protestant clergy. The number of Roman Catholics is considerable, and there are some Baptists and some Jews. Education is more diffused than in most parts of France: of the young men enrolled in the military census of 1828-29, sixty-two in every hundred could read and write: the average of the departments being less than forty in the hundred.

This department, with that of Haut Rhin, constitutes the diocese of Strasburg, the bishop of which is a suffragan of the archbishop of Besançon. It is in the jurisdiction of the Cour Royale of Colmar, and of the direction of the Académie Universitaire of Strasburg. It belongs to the fifth military division, the head-quarters of which are fixed at Strasburg, and it sends six members to the Chamber of Deputies.

At the period of the Roman conquest this department was occupied by the Nemetes and the Tribocci, two of the German nations which had settled in Gaul under Ariovistus. The part west of the Vosges (the Vogesus or Vosegus of the Romans) was included in the territory of the Mediomatrici, a Belgic nation. In the Roman division of Gaul the department was at first comprehended in the province of Gallia Belgica; and upon the dismemberment of this province, in that of Germania Superior; except that part which lies west of the Vosges, which, on the further subdivision of Belgica, was included in Belgica Prima. Several towns mentioned in Roman writers or documents were within its limits. Argentoratum occupied the site of the modern Strasburg, a corruption of Stratæ-burgus, or Stratz-burg, a name as early as the time of Gregory of Tours. The Tabernæ of the Itinerary of Antoninus and the Peutinger Table is Saverne; the Brocomagus of Ptolemy, Ammianus Marcellinus, and the Antonine Itinerary, is the modern Brumath. The Concordia of the Itinerary of Antoninus may be fixed at Alt-stat (or old town), on the Lauter below Weissemburg: the Saletio of the same authority (Ammianus Marcellinus writes it Saliso) was at Seltz on the Rhine, where the widening of the bed of the river has carried away part of the site of the town: the Helvetus of the Itinerary (called Helcebus by Ptolemy) may be fixed at a place called Ell, on the Ill near Benfelden; and the Argentovaria of the same authority was close on the border of the department near Marckolsheim.

On the overthrow of the Roman empire this part of Gaul was occupied by the Alemanni, Allemanni, or Allemans [ALEMANNI], but on the defeat of this nation by Clovis, in the great batle of Tolbiac or Zulpich (near Cologne), A.D. 496, it passed into the hands of the Franks. In the division of the empire of Charlemagne, it was included in Germany, and continued long to be a part of the empire. The name of Alsace is derived from El-sass, a very antient German name, the first part of which is the name of the river (Ill, antiently El or Hel) which waters the country. Elsass was Latinized into Elisatium and Alsatia. Under the successors of Clovis, Alsace was a duchy, and retained that designation even after the jealousy of Pepin le Bref suppressed the dignity of duke of Alsace. Towards the close of the ninth century Alsace was successively possessed by Hugues, an illegitimate son of Lothaire, king of Lorraine [LORRAINE], and Zwentibold, a natural son of Arnulph, or Arnoul, king of Germany. In the tenth century the duchy was permanently revived and held as a beneficiary dukedom (usually in conjunction with that of Suabia) until near the close of the eleventh century, when it became hereditary. Alsace comprehended what now constitutes the departments of Haut Rhin and Bas Rhin. The hereditary duchy was held by princes of the imperial house of Hohenstaufen from the year A.D. 1080, until the death of Conradin, A.D. 1268. Alsace had long previously, while under its dukes, been divided into the two counties or landgraviates of Nordgaw, or Basse Alsace, and Sundgaw, or Haute Alsace, the former of which was in the latter half of the fourteenth century united to the bishopric of Strasburg. These counties continued, after the extinction of the duchy, until the cession of Alsace to France. [ALSACE.] Several districts of Alsace were however independent of the counts or landgraves, and were under their own lords, especially under the bishops of Strasburg; and several of the towns were free Imperial towns, as Haguenau, Rosheim, Schelestat, Weissemburg, and Strasburg, in this department; Colmar, Münster, and others, in that of Haut Rhin; and Landau, now in the Bavarian territories.

RHIN, HAUT, a department of France, on the eastern frontier, bounded on the north by the department of Bas Rhin; on the east by the grand-duchy of Baden in Germany, from which it is separated by the Rhine; on the south by the territories formerly belonging to the bishopric of Basel, now incorporated with the canton of Berne in Switzerland; on the south-west by the department of Doubs; and on the west by the departments of Haute Saône and Vosges. Its form approximates to a parallelogram, having its greatest extent from north to south. The length of a line drawn from the north-western corner of the department to the frontier of Switzerland near Delemont is 64 miles; the length of a second line drawn at right angles to the first from the south-western corner to Huningue on the Rhine, is 36 miles. The area of the department is estimated at 1472 square miles, which is about two-thirds of the average area of the French departments, and about the area of the English county of Kent. The population, in 1826, was 408,741; in 1831, 424,258; and in 1836, of 447,019; showing an increase in the five years from 1831 to 1836 of 22,761, or rather more than five per cent., and giving 284 inhabitants to a square mile. In amount of population it is considerably above the average of the French departments, and in density of population very far exceeds them; it is exceeded however in both respects by the English county with which we have compared it. Colmar, the chief town, is on the Lauch, a branch of the Ill, 232 miles in a straight line east by south of Paris, or 290 miles by the road through Meaux, Château-Thierry, Châlons-sur-Marne, St. Dizier, Bar-le-Duc, Nancy, Lunéville, St. Dié (or Diey), and Schelestat; in 48° 4′ N. lat. and 7° 23′ E. long.

This department, like that of Bas Rhin, is included between the crests of the Vosges on the west and the banks of the Rhine on the east; its western side is consequently mountainous, while on the east it subsides into the valley of the Rhine. Some of the mountains, called, from their rounded forms, 'ballons' (balls), are lofty. Le Ballon d'Alsace, at the junction of the three departments of Haut Rhin, Haute Saône, and Vosges, has an elevation of 4121 feet; and Le Ballon de Guebwiller, about six or seven miles west of the town of Guebwiller, has an elevation of 4698 feet. The southern portions of the department are covered by the ramifications of the Jura. The highest summits of the Vosges are composed of granitic or other primitive rocks; in the neighbourhood of Giromagny, south of the primitive district, are the sandstones, limestones, and other formations of the carboniferous system. On the east of the primitive formations, on the lower slopes of the Vosges, are the formations of the saliferous system, including, in descending order, the variegated marls, the muschelkalk, the variegated sandstone, and the sandstone of the Vosges; and resting upon these, the oolitic series of formations, which also compose the mass of the Jura. The eastern side of the department, from the foot of the Vosges to the Rhine, is occupied by the tertiary formations. In 1834 there was only one small coal-mine in the department. Granite, porphyry, marble, rock crystal, good freestone, and gypsum are procured; and there are several mineral springs, of which those of Soultzmatt, about ten miles south-south-west of Colmar, are the most important.

Malte-Brun (3rd edit., Paris, 1832) enumerates among the mineral productions of the department, iron, copper, lead, and arsenic; but if his statement is correct, the working of the lead and copper mines must have been given up, as they do not appear in the official reports of the Direction Générale des Ponts et Chaussées et des Mines for 1835. (*Statistical View of the Mining Industry of France*, by G. R. Porter, Esq.; *presented to the British Association for the Advancement of Science*, 1838.)

There were, in 1834, twelve iron-works with five furnaces for making pig-iron, and seventeen forges for the manufacture of wrought-iron. Charcoal was the fuel chiefly if not wholly employed.

The department belongs chiefly to the basin of the Rhine. The Rhine has a considerable breadth, and an average depth of ten to twelve feet The numerous islands in the channel, formed of sand or gravel, are a serious obstruction to the navigation. The various streams which flow from the Vosges are received by the Ill, which, rising in the Jura just within the southern boundary of tne department, has a northern course parallel to the Rhine, which it joins below Strasburg, in the adjacent department of Bas Rhin. [RHIN, BAS.]

The navigation of the Ill commences at the junction of the Lauch, close to Colmar; but it is used for floating timber above that point. The Lauch and the Fecht, which join the Ill, are used for floating timber. The Largue, which rises in the Jura, has been made a feeder of the canal from the Rhône to the Rhine. The south-western part of the department belongs to the basin of the Rhône, and is watered by the Halle, the St. Nicholas, and the Savoureuse, which fall into the Doubs. None of these rivers are navigable.

The only canal in the department is that which unites the Rhône (by its tributary the Saône) with the Rhine. This canal enters the department near the junction of the little rivers Halle and St. Nicholas, and runs north-east along the valley of the St. Nicholas to the summit level near Dannemarie; from thence it runs still north-east partly along the valley of the Ill to the basin near Mühlhausen, from whence a branch proceeds to join the Rhine at Huningue near Basel, while the main branch runs northward between the Ill and the Rhine, into the department of Bas Rhin. [Rhin, Bas.] This canal was for some time called Canal de Monsieur, but is now more commonly designated from the rivers which it unites.

The inland navigation of the department is officially given in the 'Statistique de la France' as follows: Rhine, 48 miles; Ill, 10 miles; total navigable rivers 58 miles; canal from the Rhône to the Rhine 73 miles; total navigation 131 miles.

The department contains seven Routes Royales, or government roads, having an aggregate length of 215 miles; of which, on January 1, 1837, 183 miles were in good repair, and 32 miles out of repair. The principal roads are those from Paris to Huningue, to Mühlhausen, and to Colmar. The road to Huningue enters the department between Lure and Belfort or Béfort; and passes through Belfort, Dannemarie, and Altkirch, to Huningue. The road to Mühlhausen crosses the Vosges into the department near the source of the Moselle, and passes by St. Amarin and Thann to Mühlhausen, from whence it is continued to Basel. The road to Colmar enters the department on the north near Schelestat, and runs by Guemar to Colmar. A road from Strasburg runs along the valley of the Rhine by Neuf-Brisach to Basel; and another road runs from Colmar by Hallstatt, Pfaffenheim, Rouffach, and Cernay to Belfort. The departmental roads have an aggregate length of 233 miles, of which, on Jan. 1, 1837, 147 miles were in good repair, 56 miles were out of repair, and 30 miles were unfinished. The bye-roads and paths have an aggregate length of 1350 or 1400 miles.

The soil of the department is stony and barren along the bank of the Rhine and in the Vosges; the central part is more fertile; and even amid the mountains there are some valleys of eminent fertility, as those of Giromagny, Masvaux, St. Amarin, and Munster. Cultivation is carried on with great care. Of the whole area of the department, which is above 980,000 acres, nearly 390,000 acres (or about two-fifths) are under the plough: the kinds of grain chiefly cultivated are wheat, barley, and oats: of barley, the produce is considerably above the average of the departments; in wheat and oats it is considerably below the average. In rye and maslin (wheat and rye mixed), and still more in maize and buckwheat, the produce is very far below the average; and in 1827 (when Dupin published his 'Forces Productives, &c. de la France') the cultivation of the potato was scarcely known. The whole grain harvest is by no means equal to the supply of the population, and a considerable quantity of corn is brought in from other departments.

The meadows, which are very rich, amount to 130,000 acres, and the heaths and open pastures to above 70,000 acres. The number of horses, taken absolutely or with relation to the number of the inhabitants, is below the average of the departments; but as compared with the area of the department, it is above the average: the number of horned cattle is above the average in every respect; the number of sheep is comparatively small, and the growth of wool altogether inadequate to the demand: the proportion of Merinos is however unusually great. The vineyards cover about 28,000 acres: the growth of wine is about equal to the consumption: the red wines are all of ordinary quality; but several of the white wines, as those of Guebwiller, Turckheim, Ribeauvillé, Thann, Pfaffenheim, and other places, are very good. The orchards, which cover nearly 15,000 acres, are very productive, especially in cherries, from which an excellent kirschenwasser is made. Pulse, hemp, flax, tobacco, and madder are grown. The woodlands comprehend above 280,000 acres, chiefly amid the Vosges. The abundant supply of wood furnishes fuel for the various manufactures of the department. It is floated down the streams which flow into the Ill or the Doubs.

The department is divided into three arrondissements, as follows:—

Name.	Situation.	Area Sq Miles.	Communes.	Cantons.	Pop. in 1831.	Pop. in 1836.
Colmar . .	N.	654	139	13	189,589	198,403
Altkirch . .	S.E.	442	159	6	118,513	127,465
Belfort . .	S.W.	476	191	9	116,156	121,151
		1,572	489	28	424,258	447,019

The number of cantons or districts, each under a justice of the peace, appears by a later return to have been increased to twenty-nine.

In the arrondissement of Colmar are the following towns. Colmar, pop. in 1831, 15,131 for the town, or 15,442 for the whole commune; in 1836, 15,958 for the commune [Colmar]; Guebwiller, pop. 3451 for the town, 3637 for the whole commune: Rouffach, pop. 3900 for the town, or 3979 for the whole commune; Pfaffenheim, pop. 1842; Gueberschwihr, pop. 1608 for the town, or 1635 for the whole commune; Hallstatt, Hertisheim, and Eguisheim, pop. 2162 for the town, or 2183 for the whole commune, on or near the Lauch: Ensisheim, pop. 2335 for the town, or 2588 for the whole commune; and Sainte-Croix-en-plaine, pop. 1703 for the town, or 1729 for the whole commune, on or near the Ill; Neuf-Brisach, pop. 1975 for the town, or 2005 for the whole commune, between the Ill and the Rhine; Bollviller, between the Thann (a feeder of the Ill) and the Neugraberbach (a feeder of the Lauch); Soultz, pop. 3594 for the town, or 4016 for the whole commune, on the Neugraberbach; Soultzmatt, pop. 2830 for the town, or 3139 for the whole commune, on the Ombach (another feeder of the Lauch); Münster, pop. 4002 for the town, 4340 for the whole commune; Wihr-au-val; Wintzenheim, pop. 3003 for the town, or 3245 for the whole commune; Turckheim, pop. 2728 for the town, or 2736 for the whole commune; Ingersheim, pop. 1995; and Guemar, on or near the Fecht Kaiserberg, or Kaysersberg, pop. 2896 for the town, or 3053 for the whole commune; Kientzheim; Ammerschwihr, pop. 2137; and Sigolsheim, on or near the Weiss (a feeder of the Fecht): Riquewihr, pop. 1716 for the town, or 1931 for the whole commune, between the Weiss and the Strengbach (another feeder of the Fecht); Ribeauvillé, pop. 6021 for the town, or 6558 for the whole commune, on the Strengbach; Sainte-Marie-aux-Mines, pop. 5918 for the town, or 9961 for the whole commune, on the Liepvrelle; Saint Hippolyte, pop. 2304 for the town, or 2414 for the whole commune; and Ober-Bergheim, near the northern boundary of the department. Scarcely another arrondissement in France contains so many towns. Guebwiller contains a handsome church, erected in the middle of the last century: the townsmen spin cotton-yarn, weave stockings, gloves, caps, handkerchiefs, calicos, cotton prints, printed shawls, and woollen cloths, and manufacture nails, currycombs, potash, and refined sugar. Rouffach is a walled town, and in the middle ages suffered much from the wars. The townsmen are engaged in spinning cotton-yarn and weaving cottons: they have five fairs in the year. Near the town is the castle of Isemburg, where some of the Frankish kings of the Merovingian race resided. Ensisheim, which is a tolerably well-built town, is also walled and surrounded with a ditch: it has a town-hall of Gothic architecture, and an ex-Jesuits' college, now converted into a poorhouse or house of correction. It was formerly a place of considerable importance, capital of the district of Brisgau, of the Black Forest, and of the Forest towns. In the Thirty Years' War it was repeatedly taken and retaken. The townsmen spin woollen yarn. Neuf-Brisach, or New Brisach, is of importance only as a place of strength: it was built by Louis XIV., to serve as a check to the fortress of Alt-Brisach (Old Brisach) in Baden, on the opposite side of the Rhine, and was fortified by Vauban on the most improved principles. The streets are straight, and the houses regularly built, but low, so as not to be visible outside the fortifications. Bollviller has some cotton-manufactures, and one of the most extensive nursery-grounds in France. It is especially rich in vines, fruit-trees, shrubs, and exotics. Soultz has manufactures of silk ribbon: there is a yearly fair. Soultzmatt has mineral waters, the most frequented in the department; the townsmen spin cotton-yarn, and weave muslins and linens. Münster owes its origin to a Benedictine abbey, founded in the seventh century. It was antiently fortified, and suffered much in the Thirty Years' War. The townsmen are engaged in the manufacture of cottons, plain and printed, muslins, and paper; and carry on trade in cattle, butter, cheese, and kirschenwasser: the master manufacturers are honorably distinguished by their care for the instruction of their workmen. Cottons and woollen goods are manufactured at Wintzenheim, and peat is dug in the neighbourhood. Turckheim, one of the free cities of Alsace, was signalised by a victory of Turenne over the Imperialists, A.D. 1675: it is a small ill-built town; the townsmen trade in the wine of the neighbourhood, which is in good repute. Kaiserberg, founded by the emperor Frederick II., who surrounded it with walls, was antiently a free imperial city. It was repeatedly taken and retaken in the seventeenth century. The town is well built: the manufacture of cotton-yarn, of calicos and other cotton goods, and of machinery for spinning cotton, is carried on. The neighbourhood of this town and of Ammerschwihr produces excellent wines. At Ribeauvillé, cotton handkerchiefs and other cotton goods are manufactured: near the town are the ruins of the castle of Ribeaupierre. Sainte-Marie-aux-Mines (in German, Mariakirch, or Markirch), is, next to Colmar, the most important place in the arrondissement: it is near one of the passes of the Vosges, in an agreeable situation: the Liepvrelle divides it into two parts. It derives its name from the copper and lead mines formerly worked in the neighbourhood, but the working of these has been gradually given up. The chief occupation of the townsmen at present is the manufacture of cotton and woollen yarn, of linens, woollens, and cottons, including handkerchiefs and printed calicos, and of leather and paper. There are extensive bleaching-grounds and some dye-houses. The town has a chamber of manufactures. There are two yearly fairs. St. Hippolyte is defended by a strong castle: it has an hospital.

In the arrondissement of Altkirch are Altkirch, pop. in 1831, 2724 for the town, or 2819 for the whole commune; in 1836, 3028 for the commune; Ferette; and Mühlhausen, pop. 13,187 for the town, or 13,300 for the whole commune [MUHLHAUSEN], all on or near the Ill: Huningue or Huningen, and Gros Kembs or Kemps, on the Rhine; and Landser, between the Ill and the Rhine. Altkirch was built early in the thirteenth century by one of the counts of Ferette. There are some antient towers yet standing. The townsmen manufacture leather, and there is a monthly fair for cattle. The town has a subordinate court of justice and a high school. Ferette has the ruins of an old castle: eight fairs are held in the town in the year. Huningue, or Huningen, was originally a fortress, constructed by order of Louis XIV., and fortified by Vauban: it had barracks for 4000 men. In 1814, and again in 1815, it was besieged by the allies; on the last occasion it was bravely defended by a mere handful of men against a considerable Austrian army: it was however obliged to capitulate, and the fortifications were destroyed at the solicitation of the citizens of Basel, within cannon-shot of which town Huningue is situated.

In the arrondissement of Belfort, or Béfort, are Belfort, pop. in 1831, 4537 for the town, or 5753 for the whole commune; in 1836, 5687 for the commune [BEFORT]; Giromagny, pop. 1603 for the town, or 2166 for the whole commune: Delle, on the Halle; Dannemarie, near the Largues; Massevaux, pop. 2531 for the town, or 3653 for the whole commune, on the Doller, a feeder of the Ill; St. Amarin, pop. 1662 for the town, or 1995 for the whole commune; Thann, pop. 3802 for the town, or 3937 for the whole commune; and Cernay, pop. 3407 for the town, or 3416 for the whole commune, on the Thann, another feeder of the Ill. At Giromagny cottons are manufactured, and a monthly fair is held for corn and cattle. At Delle tiles are made, and there are a fulling-mill and a mill for grinding bark; and at Dannemarie there are tanyards and dye-houses. Massevaux, sometimes called Masmünster, has manufactures of cotton yarn and cotton goods, copper-works and iron-furnaces: there are six yearly fairs. There are cotton-manufactories and iron-furnaces at St. Amarin, a town very pleasantly situated: there are two fairs, where hardwares, woven goods, and cattle are sold. Thann [illegible] a fine old Gothic church, dedicated to St. Théobald, [illegible]rkable for its spire, which is an imitation of that of Strasburg: the ruins of the castle of Enguelbert, near the town, are also deserving of notice. Cotton-yarn and cotton goods, including printed calicos, are manufactured; also machinery, starch, gunpowder, salt, and chemical productions. The town had its origin in the twelfth century, and in the middle ages enjoyed many privileges: it was taken by the Swedes in the Thirty Years' War. Gobel, the archbishop of Paris, who renounced the belief of a God, in the height of the revolutionary frenzy, and perished on the scaffold, was a native of Thann. At Cernay cotton-yarn is spun; calicos, cotton prints, and woollen cloths woven; and iron goods, machinery, and paper are made: there are bleach-grounds for linen. At Morvillard, a village near Delle, are some important wire-works; at Niederbrurck are copper and brass works; and at Wesserling, near Cernay, cotton mills and a factory for cotton prints.

The department is included, with that of Bas Rhin, in the diocese of Strasburg; it is in the jurisdiction of the Cour Royale of Colmar, and in the district of the Académie Universitaire of Strasburg. It is included in the fifth military division, the head-quarters of which are at Strasburg. It sends five members to the Chamber of Deputies. In respect of education, it is in advance of the greater number of the departments. Of the young men enrolled in the military census of 1828-29, 71 in every 100 could read and write; the average number in the whole of the departments was 39 in every 100. Only four departments, Meuse, Doubs, Jura, and Haute Marne, exceeded that of Haut Rhin.

In the time of Cæsar this department, which had probably been antecedently a part of the territory of the Sequani, was in great part occupied by the Rauraci, part of the German subjects or allies of Ariovistus: the northern part was probably included in the territory of the Tribocci, another German people; while the south-western parts abou Belfort were retained by the Sequani. In the Roman division of Gaul by Augustus, the territory of all these nations was included in the Belgic province, although the Sequani were a Celtic people; but in the further subdivision made by the Romans, the territories of the Sequani and Rauraci were included in Maxima Sequanorum; while those of the Tribocci were included in Germania Superior or Prima. Several Gallic or Roman towns were within the limits of the department. Argentovaria ('Αργεντουαρία), which Ptolemy mentions as a town of the Rauraci, and near which the Roman emperor Gratian defeated the Alemanni, or Allemans, A.D. 378, was probably just on the border between Arzenheim and Markolsheim (Bas Rhin). Some antiquarians have endeavoured to fix it at Colmar. The Mons Brisiacus of the 'Itinerary' of Antoninus was on the Gallic side of the Rhine, on or near the site of Alt or Old Brisach, which is now, probably by the river shifting its bed, on the German side. Rufiana ('Ρουφιάνα), which Ptolemy (apparently by mistake) assigns to the Nemetes, was pr bably at Rouffach. The Stabula, Cambes, Urunci, Larga, and Gramatum of the 'Itinerary' of Antoninus may be fixed respectively at a spot between Ottmarsheim and Bauzenheim, at Gros Kembs, at Ricsen or Rucsen, not far from Mühlhausen; at Largitzen, on or near the Largues, not far from Altkirch; and at Granvillars or Grand Villars, on the Halle, near Delle. The Arialbinnum of the Peutinger Table and the 'Itinerary' of Antoninus, and the Olino Rauracorum of the 'Notitia,' were, the first at Binning, in this department, between Gros Kembs and Basel, the latter possibly at Holé, near Basel.

On the overthrow of the Roman empire, the department was ravaged by the Allemans and the Huns, and subsequently possessed by the Burgundians. On the overthrow of the Burgundian kingdom, it passed to the Franks. In the middle ages it was included in the province of Alsace, long a portion of Germany, but conquered by Louis XIV., and annexed to France. [ALSACE; RHIN, BAS.]

RHINE. This river is, in respect of length, the fourth of European rivers, being inferior to the Volga, Danube, and Dnieper; but if it be viewed as a channel of commerce, it is certainly the first river of continental Europe. It rises in the Alps of Switzerland, in several parts of its course separates that country from Germany, afterwards divides Germany from France, traverses the territories of several princes belonging to the German Confederation, and lastly it drains the plains of Holland, where it reaches the sea by several arms. That portion of the river which lies within or along the boundary-line of Switzerland is called the Upper Rhine; from Basel to Köln, or Cologne, it is denominated the Middle Rhine; and the remainder of the course, to its several mouths, the Lower Rhine.

Upper Rhine.—The river originates in three branches in that elevated chain of the Alps which runs eastward from the mountain-road of St. Gothard through Graubündten, or the country of the Grisons. The most eastern of these three branches, called by German geographers the Vorder

Rhein (Fore Rhine) is considered the principal. It rises in two small lakes, situated on the eastern declivity of Mount Badus, belonging to the St. Gothard's group, about 7500 feet above the sea-level. These lakes are called the Lake of Toma and Lake of Sera. It runs in a ravine like a torrent, and about twelve miles from its source, at Dissentis, where it is met by the second branch, the Mittel (Middle) Rhein, it is hardly more than 3600 feet above the sea. It continues its course for about 40 miles more in an east by north direction, to Reichenau and Chur. At Reichenau the waters are increased by the third branch, called the Hinter (Hinder) Rhein, and at Chur it is nearly 250 feet wide, its waters having been increased by numerous small tributaries. From Chur downwards it is navigated by small flat river-boats, and it begins to run through a valley from one to two miles wide, in a nearly northern direction towards the Boden See, or Lake of Constance. This valley is nearly 50 miles long. About 20 miles north of Chur two mountains come close up to the banks of the river, so as not to leave even space for a road. The eastern is called the Fäscherberg, and the western the Schollberg. Their declivities along the river are extremely steep, and there is reason to suppose that the two mountains at some remote time formed one mass, and that the course of the river was different from what it is at present. In fact a low tract of alluvial ground extends south of the Schollberg westward to the small town of Sargans in St. Gallen, and thence to the Lake of Wallenstadt. Between this lake and that of Zürich there is also a broad tract of level alluvial ground, in which the Linth Canal has been made. As the ground between the present course of the Rhine and the Lake of Wallenstadt is little more than 20 feet above the level of the river, it is supposed that the Rhine formerly took its course through this low ground, and passing through the lakes of Wallenstadt and Zürich, followed the course of the Limmat River, which joins the Aar opposite the village of Rain. When the Rhine is unusually swollen there is some danger of its returning to this its supposed antient bed. In 1817 and 1821 the danger was only averted by the great efforts of the inhabitants of the adjacent places. North of the narrow passage between the Schollberg and Fäscherberg the valley is much wider, and here the river constitutes the boundary-line between the Austrian monarchy and Switzerland. Where the river enters the Boden See it runs through a swampy tract of small extent. [CONSTANZ, LAKE OF.] The river issues from the lake at Constanz, which is 1344 feet above the sea-level, and flowing in a western direction for a few miles, enters the Unter See (Lower Lake), which is about thirty feet lower than the Boden See. In this tract, and as far as Schaffhausen, the Rhine is navigable for large boats, but below the last-mentioned place its waters rush over a rock, which is between 65 and 70 feet high, and this waterfall is called the cataract of Schaffhausen or Laufen. The last name is derived from that of a castle which is contiguous to the waterfall. At Schaffhausen the surface of the Rhine is 1260 feet above the sea-level. Below this cataract the course of the river is very tortuous, between mountains and high hills, but its general direction is towards the west. Nearly fifty miles below Schaffhausen the navigation is again interrupted by a cataract, at the town of Laufenburg, where the bed is narrowed by projecting rocks to about fifty feet. At this point goods must be unshipped, and the barges descend the river by means of ropes. The last and least impediment to navigation in the Upper Rhine occurs near Rheinfelden, about ten miles below Laufenburg, where a rapid of some length occurs, which does not stop the navigation, but is fatal to many boats which navigate this part of the river. It is called the Höllenhacken (Hook of Hell). Below this rapid the river is only 850 feet above the sea; and at Basel only 800 feet.

Numerous tributaries join the Rhine in its upper course above Basel, but none of them are navigable or otherwise remarkable, with the exception of the Aar. This river drains the greater part of Switzerland, and is at least equal to the Rhine in the volume of water which it brings down. The Aar originates in the mountain-masses which lie west of the mountain-road of the St. Gothard, and, from being always covered with snow and glaciers, are comprehended under the general name of Aar-Gletscher, or Aar-Glaciers. The upper part is in a narrow valley between very high mountains, in a general north-west direction, and in these parts it forms a cataract about 150 feet high, which is called the Aarfall, or Fall of the Aar, near the hamlet of Handeck. After a course of about 30 miles, the Aar falls into the lake of Brienz, which is about nine miles long, and somewhat more than a mile wide, very deep, and 2060 feet above the sea-level. After issuing from that lake, the Aar runs hardly three miles before it enters the lake of Thun, which is nearly twelve miles long, and on an average about three miles wide; it is 1875 feet above the sea-level. Issuing from the north-western extremity of the lake, the Aar flows first in a north-west, then in a west, and lastly in a northern direction, traversing the elevated and hilly plain of Bern nearly in the middle. Above the town of Bern it is not much navigated on account of the rapidity of its course, but a considerable quantity of wood is floated down. Below Bern it is navigated by river barges of moderate size. At Aarberg the river approaches the foot of the Jura Mountains, along the base of which it flows in a north-eastern direction as far as Aarau, north of which it enters the mountain-region which separates the plain of Bern from the valley of the Rhine, and in its tortuous course through this hilly tract the waters of the Reuss and of the Limmat join it, before it falls into the Rhine at Coblenz, a short distance above Waldshut. The whole course of the Aar exceeds 160 miles. The Reuss and the Limmat fall into the Aar near 47° 30′ N. lat., and hardly one mile from one another. The Reuss originates between the sources of the Aar and those of the Rhine, in the mountains which lie on both sides of the road that traverses the St. Gothard and its upper course, which is nearly due north, is frequently broken by rapids and cataracts, among which those of Hospital, Andermett, and Amsteg are admired for their beauty. At the village of Klus it leaves the narrow valley, and three miles farther north it falls into the Lake of Luzern, or the Vierwaldstädter See, so much admired for the picturesque beauty of the country which bounds its shores. The form of this lake is extremely irregular: it is 1434 feet above the sea-level. Issuing from the north-western extremity of the lake, the Reuss flows generally in a northern direction, and chiefly through a hilly country, about forty miles to its confluence with the Aar near Brugg. The other great tributary of the Aar brings to it the waters of the lakes of Wallenstadt and Zürich. The former lake is about nine miles long, and more than a mile across, generally from 60 to 80 fathoms deep, and 1422 feet above the sea-level. It is united to the Lake of Zürich by the Linth and a canal. The Lake of Zürich has the form of an arch, and is about twenty-five miles long and two miles wide. It is 1310 feet above the sea. Issuing from the north-western extremity of the lake, the Limmat flows for about twenty miles through a hilly country, in a west by north direction, and falls into the Aar opposite the village of Rain. Both the Reuss and the Limmat are navigable, but on account of the rapidity of their current they are ascended only by empty barges. The Linth and its canal are also navigated.

Middle Rhine.—At Basel, where this division of the river begins, it has entirely left the mountain-region of the Alps and Jura Mountains, and at the same time it changes its western into a north-north-eastern and northern course. It flows in a valley from forty to fifty miles wide, extending between the Black Forest (Schwarzwald) and the mountains connected with it on the east, on the one side, and the Vosges and their northern prolongation the Hardt Mountains on the west, from Basel to Mainz, a distance of nearly 200 miles. At Mainz the surface of the river is only 274 feet above the sea; the fall between Basel and Mainz is therefore 536 feet, or more than 2½ feet per mile. At Kehl, in the parallel of Strasburg, the surface of the river is 453 feet above the sea. The distance of Strasburg from Basel is about eighty miles, in which space the river descends 347 feet, or 4⅓ feet per mile. In addition to the great rapidity of the current, the wide bed of the river contains numerous sand-banks and small islands, which are subject to sudden and frequent changes in their form and position. Navigation in this part of the Rhine is accordingly limited. The river barges employed are only from 20 to 24 tons burden, and can only take in a third of that weight in ascending the river, when they must be drawn up. Small steamboats ascend as far as Basel. Between Kehl and Mainz, a distance of more than 120 miles, the fall of the Rhine does not exceed 179 feet, or about 1½ feet per mile. Between Kehl and Germersheim, which places are about fifty miles distant from one another, the islands do not decrease in number, but they increase in size, and are less subject to change. Few islands occur north of Germersheim, and the river flows slowly, making large bends. The largest kind of barges used between Strasburg and Mainz are of 100 tons burden, but in ascending they must be drawn up, which is chiefly done by horses.

Between Mainz and Bonn the Rhine runs between two mountain-regions in a narrow valley. This valley, which contains some of the most picturesque scenery on the continent of Europe, is in some parts so narrow, that there is hardly level space enough for a road between the mountains and the banks of the river. The hills along the banks of the stream contain extensive vineyards, the produce of which is known all over Europe under the name of Rhenish wines. The direction of the river from Mainz to Bingen is westward, but below Bingen it runs to the west of north. Within this part there are some dangerous places. At Bingin a ledge of rocks crosses the river, and though the Prussian government has lately somewhat lessened the danger by blasting some of the rocks, yet the impediment is not quite removed, and neither barges nor steam-boats can pass by night or in foggy weather. Near Bacharach, farther down, there is a group of rocks, and opposite St. Goar another ledge, which however is much less dangerous than that near Bingen. Between Mainz and Köln, a distance somewhat exceeding a hundred miles, the river descends 164 feet, or little more than 1½ feet per mile: at Köln it is only 110 feet above the sea-level. Numerous barges navigate within these limits, and the largest of them vary between 120 and 150 tons. The ascent is very tedious, and requires much time.

Numerous tributaries join the Rhine in its middle course. Those which flow into it from the west have a short course, and are not navigable, with the exception of the Moselle, which rises on the western slopes of the Vosges, and runs first north-west, and then north, but the greater part of its course is to the north-east. After a course of 280 miles, it joins the Rhine at Coblenz. It is navigable as far as its confluence with the Meurthe, about 160 miles from its mouth. The upper part of its course lies between hills, the middle part through the plain of Lorraine, and the lower part in a deep valley of moderate width. The slopes of the hills and mountains enclosing this valley are covered with extensive vineyards, which produce the Moselle wine. The largest of its tributaries, the Saar or Sarre, which joins it above Trier, is navigable for large river barges as far as Saarebrück, a distance of about 45 miles from its mouth, and 10 miles more for small barges.

The number of navigable rivers which join the Rhine in its middle course from the right is much greater. The most southern is the Neckar, which rises near 48° N. lat., in the mountainous tracts by which the range called the Rauhe Alp is connected with the Black Forest. Its course for more than 30 miles is northward, and afterwards north-east along the base of the Rauhe Alp for about the same distance. Ten miles above Stuttgard it turns north-west, but below that town its general course is north for about 80 miles, when it turns to the west, and after flowing in that direction 30 miles, falls into the Rhine at Mannheim. The whole course of the Neckar is above 180 miles, and, with the exception of the first 30 miles, lies through a country swelling continually into gentle hills of moderate elevation, which are carefully cultivated, and produce excellent wine. It begins to be navigable at Kannstadt, near Stuttgard, for small barges; but below Heilbronn it is navigated by barges of 20 tons. One of its tributaries, the Enz, which falls into it from the left, is navigable to Vahingen, about 10 miles upwards.

The most important of the affluents of the Rhine is the Main or Mayn, which falls into it opposite Mainz. Its sources are in the Fichtelgebirge, not far from the boundary of Bohemia, where it originates in two branches, of which the northern is called the White and the southern the Red Main. The two branches unite about two miles and a half below Kulmbach, and begin to change their western course into a southern. Not far from Bamberg the river is joined by the Rednitze: it then flows west by north to Schweinfurt, whence it again runs south to Markbreit, and from that place to the north-north-west to Gemünden. From Gemünden it again flows southward, and making a wide sweep, encircles the mountain-region of the Spessart. At Hanau it turns westward, and passing near Frankfort in that direction, joins the Rhine. Though its sources are only about 150 miles from its mouth, the whole course exceeds 360 miles, owing to the numerous large bends. This circumstance renders it one of the most navigable rivers on the Continent. River barges ascend above the mouth of the Rednitz, more than 250 miles from its mouth; and from Kitzingen downwards, it is navigated by vessels of 100 tons burden. The whole course lies through a hilly but rather fertile and well-cultivated country. The Rednitz is the only affluent of the Main which is navigable. The navigation of the larger river barges, from 25 to 30 tons burden, ceases at Forchheim. As no high hills intervene in those parts between the Main and the Danube, a canal, which originally was projected by Charlemagne, is now in progress, which is to extend from Forchheim along the banks of the Rednitz and those of the Altmühl to the Danube. This canal will establish a water communication between the North Sea and the Black Sea.

Farther north the Rhine is joined by the Lahn, which falls into it a little above the mouth of the Moselle at Niederlahnstein: it flows about 140 miles, and is navigable for moderate-sized river boats to Diez, about 20 miles from its mouth, and for smaller boats to Wetzlar, about 70 miles from its confluence with the Rhine. It traverses a very hilly country. The river Sieg, which falls into the Rhine below Bonn, flows about 70 miles, and is navigable to Siegburg, which is about eight miles from its mouth.

Lower Rhine.—From Köln to its mouths, a distance of about 300 miles, the course of the Rhine is through a low level country, though the western declivity of the hills of the Sauerland are near its eastern bank, between Köln and Düsseldorf. The current is extremely gentle, as the whole fall does not amount to much more than four inches per mile, the surface at Köln being, as already observed, only 110 feet above the sea-level. From this town downwards the Rhine may be navigated by sea-vessels from 300 to 400 tons burden; and a few years ago, a vessel cleared out from Köln for New York. But flat river barges are generally used, on account of the numerous sand-banks which narrow the navigable channel.

About 200 miles from its mouth, and soon after it has entered Holland, the Rhine begins to divide into several arms; but before this division, the waters are increased by three navigable rivers, by the Erft from the left, and by the Ruhr and Lippe from the right. The Erft, which falls into the Rhine above Düsseldorf, flows about 60 miles, but is only navigable a few miles above its junction with the Rhine. The Ruhr, whose course is generally to the west for above 100 miles, is navigable for boats about one-half of its course, to Langschede above Schwerdt. Its course being rapid, it has been made navigable by the construction of sixteen locks; it is generally navigated by coal-barges, as the adjacent country contains the richest coal-measures in Northern Germany. The number of these barges is stated to amount to 3000. The Ruhr falls into the Rhine at Ruhrort. The Lippe, which joins the Rhine near Wesel, is somewhat more than 100 miles long, and is navigated from Lippstadt by small river-boats, and from Lünen by large ones.

Near the village of Pannerden, which is within the territories of Holland, the Rhine divides into two arms, of which the southern is called the Waal, and the northern preserves the name of Rhine. Nearly two-thirds of the volume of water run into the Waal, which is more than 210 yards wide, while the Rhine is only 114 yards wide. The Waal runs westward, and the Rhine north-north-west. The Rhine divides again about 12 miles lower down, above Arnheim, into the Yssel, which runs to the north, and the Rhine, which runs off to the west. The Yssel was originally a canal, cut by Drusus, to unite the Rhine with the river which now is called Oulde (Old) Yssel. It falls into the Zuider Zee. The Rhine running westward divides for the third time about 30 miles lower down, at Wyck by Duurstede. The southern arm is called the Leck, and the northern goes by the name of Kromme Rhyn (Crooked Rhine): the Leck is the larger river. The Crooked Rhine runs north-west to Utrecht, where it divides for the fourth and last time. The arm which runs northwards is called the Vecht, and falls into the Zuider Zee; the other, whose name is changed into that of Oulde Ryn (Old Rhine), continues westward through the marshes of Holland, where the waters are used for feeding numerous small canals. It passes through Leyden, and formerly did not reach the sea, being prevented by some sandy dunes which line the shores of this part of Holland; but in 1807 a canal was made through them, and the river now discharges a small quantity of water into the sea at Katwyck, north-west of Leyden.

The Leck, or middle branch of the Rhine, was originally also a canal, made by the Roman general Corbulo; and it existed as such to A.D. 839, when the bed was greatly enlarged by an inundation, and thus it became the principal river, and the true Rhine was reduced to insignificance. It runs from Wyck by Duurstede westward for about 50 miles, when it is joined from the south by a branch of the Maas or Meuse, called the Merwe or Merwede. On approaching the sea, another arm of the Maas, called the Oulde Maas (Old Maas), joins it, and hence to its mouth the wide æstuary of the river is called the Maas.

The Maas or Meuse rises near 48° N. lat., in the French department of Haute Marne, in that ridge of high land which unites the chain of Côte d'Or with the Vosges, and is called Monts de Faucille. Its general direction through France to Sedan is to the west of north; then for a few miles west, and again north, until it reaches Namur, whence it flows first to the north of east to Lüttich or Liege, and thence to the east of north to Venlo and Broekhuizen. From the last-mentioned place it declines to the north-west, and, before it reaches Grave, to the west, in which direction it flows nearly parallel to the Waal for more than 80 miles, approaching that river in one place within two miles. Both rivers unite at Gorkum, and the name of the Waal is merged in that of the Maas. The course of the Maas to its confluence with the Waal is about 460 miles. The Waal runs about 80 miles from the Pannerden to Gorkum. After its junction with the Waal, the Maas likewise divides. The first division occurs a few miles west of Gorkum, near the village of Hardingsvelt. One arm runs southward, under the name of West Kil; and the other, the Merwe or Merwede, to the west. The Merwede afterwards divides again into the proper Merwede and the Oulde Maas, both of which unite with the Leck, as already observed. The West Kil forms the Bies Bosch, a kind of lake, literally strewed with small islands covered with low trees; turning westward it is called Hollands Diep. This Hollands Diep, which is about two miles wide, divides also into two arms, of which the northern, called the Haring Vliet, is about two miles wide; but towards its mouth it widens to three miles, and is called Rivier Flakkee, or Shallow River. The southern arm is known by the names of Volke Rak and Krammer in different places, and is more than a mile across, but full of shoals. Between the two arms of the Hollands Diep is the island of Over Flakkee. An arm of the Krammer runs into the Ooster Schelde. Thus the Rhine reaches the sea by four mouths, the Oulde Rhine, the Maas, the Rivier Flakkee, and the Krammer. The whole country between the arms of the Rhine, after its division at Sterneschanze, is intersected by numerous canals, most of which serve for the purpose of internal navigation, though only for small boats.

The whole course of the Rhine amounts to about 950 miles, of which about 350 are included in the middle course, the upper and lower course not exceeding 300 miles.

The delta of the Rhine is bounded on the east by the Yssel, on the south by the Waal and Maas, and on the other sides by the North Sea and the Zuider Zee: it comprehends the whole of the three Dutch provinces of North and South Holland and Utrecht, and nearly two-thirds of Guelderland. Within these limits it occupies about 4150 square miles; but the whole of this surface is not level or alluvial ground, for nearly the western half of Utrecht, and that part of Guelderland which is between the Rhine, the Yssel, and the Zuider Zee, is slightly hilly, and the soil is not alluvial. When this hilly tract, which occupies about 1128 square miles, is subtracted, the alluvial portion of the delta does not exceed 3030 square miles. To this however must be added the extensive alluvial tracts which line the Yssel, the Waal, and the Maas beyond the limits of the delta as here defined, and occupy about 1000 square miles. If the greater part of the province of Zealand, which is contiguous to these lowlands (about 500 square miles), and the low tracts on both sides of the Rhine above its division, from Wesel downwards (250 square miles), are added, the whole extent of the low country near the mouths of the Rhine is 4780 square miles. All this country would occasionally be covered with the inundations of the river, or by the sea, if it were not protected by embankments. The river embankments begin at Wesel, in the Prussian province of Düsseldorf, and extend on both sides of the different arms of the Rhine to the sea. These embankments are generally from 25 to 30 feet above the lowest level of the river. In the basin of the Rhine the winter usually lasts from six weeks to two months, during which time the river is covered with ice, and the snow accumulates in the adjacent countries. If the snow has fallen in greater quantities than usual, and is suddenly dissolved by warm rains, the river in a short time swells to an extraordinary height, and lays the contiguous low lands under water. No part of these low lands is more subject to such inundations than the Betuwe, or that tract which extends between the Rhine and Leck on the north and the Waal on the south. When such inundations take place, they are always attended with great loss of property, and sometimes of life, as was the case in the great inundation of 1799. In that year the masses of ice stopped the current, and the water, rising to the level of the embankments, poured over them like a cataract into the adjacent low lands. According to a rough estimate, about one thousand square miles were thus laid under water.

The basin of the Rhine, according to a tolerably accurate calculation, covers a surface of 79,482 square miles, or about 7000 square miles less than the area of Great Britain. The *Upper basin* of the river resembles a triangle, whose base extends, near 46° 30′ N. lat., over 4 degrees of longitude (from 6° to 10° E. long.), and consequently is 180 miles in length. Between 10° and 7° it is formed by the highest ranges of the Alps, and between 7° and 6° by the Jorat mountains and the Jura. The eastern border of the Upper basin extends along 10° E. long. from 46° 30′ to 48°, and is somewhat more than 100 miles long. It is mostly formed by high ranges, which are offsets of the Alps. The third line of the triangle is not a straight line. It begins on the south, near the place where 6° E. long. is cut by 46° 30′ N. lat., and extends along the Jura mountains to Basel and the Schwarzwald in a north-eastern direction, until in approaching 48° N. lat. it turns east and runs in that direction to 10° E. long. This portion of the basin contains 12,820 square miles: viz., of Switzerland, 10,300; of Austria, 860; of Wirtemberg, 360; of Baden, 1300: total, 12,820; and the whole of it, with the exception of a comparatively small tract, is from 1300 to 1400 feet above the sea-level; many parts indeed rise much higher, especially those which are enclosed by the ranges of the Alps.

The *Middle* basin of the Rhine lies between 48° and 51° N. lat. On the west side of the river, its margin extends from the northern part of the Jura mountains westward across the southern parts of the Vosges mountains to the Monts de Faucille, or those heights in which the Seine, Maas, Moselle, and Saône originate. It then continues northward along the ridge of hills which separate the valleys of the rivers Maas and Moselle to the Ardennes, and afterwards north-east over the mountain-region of the Eifel to Bonn. This portion of the Middle basin occupies 18,355 square miles, of which there are

	Sq. M.
In France (departments of Haut Rhin, Bas Rhin, Moselle, Meurthe, and about half of the Vosges) . . .	9,731
In Bavaria (Rheinkreiss) . . .	2,213
In Oldenburg (Birkenfeld) . . .	195
In Prussia (Coblenz, Trier) . . .	4,806
In Luxemburg	1,410
	18,355

On the east side of the river, the outer edge of the Rhine begins near the source of the Danube, whence it extends along the ridge of the Rauhe Alp east by north, until it reaches the place where 10° 30′ E. long. is cut by 49° N. lat. Thence it extends north-east over the hilly plain of Franconia, where several tributaries of the Danube and Rhine interlock, to the Fichtelgebirge (50° N. lat.). In this parallel the basin of the Rhine has attained its greatest width, extending from the source of the Sambre (3° 40′ E. lat.) to that of the Main (11° 40′), about 320 miles. From the Fichtelgebirge the outer border of the basin runs along the Frankenwald and Thüringerwald west-north-west to the sources of the Werra, and thence westward over the Rhön mountains, the Vogelsberg, and Westerwald to the mouth of the Sieg, where it terminates at the Siebengebirge opposite Bonn. The eastern portion of the Middle basin contains 21468 square miles, viz.:—

Of Wirtemberg . . .	5,320
Of Baden	4,644
Of Bavaria	6,944

Of Darmstadt	2,387
Hesse-Homburg	172
Nassau	1,801
Of Prussia (Coblenz)	200
	21,468

Thus the whole of the Middle basin has an area of 39,823 square miles.

The Lower basin of the Rhine lies between 50° 40′ and 52° 40′ N. lat., except a long narrow tract which comprehends the Upper basin of its confluent the Maas, and which extends southwards along the western edge of the Middle basin to 48° N. lat., or to the Monts de Faucille. This valley is separated from the basin of the Seine by the Forêt des Argonnes. At this place the basin of the Maas begins to border on that of the Schelde. The watershed between these two rivers extends south-west and north-east, and is formed by a hilly country of moderate elevation, which terminates in the neighbourhood of Maastricht. From this place the watershed between the two rivers extends north-west and west, and is formed by a broad tract of elevated ground covered with moors and heaths. The left portion of the Lower basin contains an area of 15,495 square miles, of which there belong

To France (in the departments of Meuse, Vosges, Ardennes, and Du Nord)	4,551
„ Luxemburg	1,301
„ Prussia (Aachen, Köln, and Düsseldorf)	3,581
„ Belgium (Liege, Limburg, Namur, Hennegau)	4,065
„ the Netherlands (North Brabant)	1,996
	15,495

On the right side of the Rhine, the outer edge of the Lower basin extends from the source of the river Sieg, which is in the Westerwald, north-eastward to the ridge called the Osning. Thence it runs along the northern side of the valley of the Lippe westward over an elevated tract covered with heath. The remainder of the border of this part of the basin is in the moorlands which are drained by the Reege, a confluent of the Vecht, and it terminates in the alluvial tracts which extend northward from Zwoll on the Yssel. The area of the right portion of the Lower basin of the Rhine, including the islands which lie between its arms, amounts to 11,344 square miles, comprehending

Of Prussia (Minden, Münster, Arensberg, Köln, Düsseldorf)	6,725
Of the Netherlands (Guelderland, Utrecht, and Holland)	4,619
	11,344

The whole of the Lower basin of the Rhine covers 26,839 square miles.

Though the basin of the Rhine extends from 46° 30′ to 52° N. lat., nearly the whole of it has the same climate. The distance between the Upper and Lower basin, amounting to about five degrees, is compensated by the greater elevation of the Upper basin. Thus the plains of Switzerland, which are about 1400 feet high, resemble in climate the low countries which lie between 51° and 52° N. lat. The countries in the middle basin, being less elevated in proportion, enjoy a somewhat milder climate than the plains of Switzerland and the low lands near the mouth of the Rhine.

RHINE, ANTIENT (*Rhenus*, 'Ρῆνος.) The Romans first became acquainted with the Rhine by the conquests of Julius Cæsar in Gaul, who crossed it twice to punish the Germans. (Cæs., *Bell. Gall.*, iv. 16, 17; vi. 9.) He knew however nothing of the northern or southern part of the river except from report, and appears himself never to have gone farther north than the Scaldis (Schelde), though his cavalry on one occasion reached the country where the Rhine and the Mosa meet. (*Id.*, vi. 33; iv. 15.) According to his account, the Rhine rises in the country of the Lepontii, who inhabit the Alps, and flows rapidly a long distance through the territories of the Nantuates, Helvetii, Sequani, Mediomatrici, Triboci, and Treviri; and when it approaches the ocean it divides itself into many branches, and after forming several great islands, flows into the ocean by many mouths. (*Id.*, iv. 10.)

The campaigns of Drusus and Tiberius in Rhætia and the north-western parts of Germany gave the Romans a more accurate knowledge of the course of this river. According to Strabo, it rises in Mount Adula (St. Gothard), which is part of the Alpes Rhæticæ, and at no great distance from the sources of the Rhône. Thence it flows northwards, and forms marshes and a great lake, by which Strabo must mean the Lacus Brigantinus (Boden See, or Lake of Constance); it afterwards becomes a river again, and flows parallel to the Sequana. It falls into the sea opposite Cantium (Kent), which could be seen from the mouths of the Rhine. Asinius said that the river was 6000 stadia in length, but Strabo thought that it would not be more than half that length if it flowed in a straight line; and that on account of its rapidity not more than 1000 stadia ought to be allowed for windings in its course. (Strab., iv., p. 192, 193, 204; ii., p. 128; i., p. 63.) Tacitus also states (*Germ.*, c. 1) that the Rhine rises in the Rhætian Alps.

Antient writers differ respecting the number of mouths by which the Rhine falls into the ocean. Cæsar, as already stated, says that there are several, but most other writers speak only of two or three. Virgil (*Æn.*, viii. 727), Asinius (Strab., iv., p. 193), and Tacitus (*Ann.*, ii. 6) speak only of two; of which, according to Tacitus, the western is called Vahalis till its union with the Mosa, when it takes the name of the latter river, while the eastern, which forms the boundary between Gaul and Germany, preserves the name of Rhine. Pliny (*Hist. Nat.*, iv. 29), Ptolemæus (ii. 9), and other writers say that the Rhine falls into the sea by three mouths, of which the eastern, according to Pliny, was called Flevum, and the western, formed by the union with the Mosa, Helium; while the middle one, which was only a stream of moderate size, retained the name of Rhine. The channel called Flevum is supposed to have been formed by the canal which Drusus dug to connect the Rhine with the Isala, and by means of which he and Germanicus sailed to the ocean. (Suet., *Claud.*, c. i.; Tac., *Ann.*, ii. 8.) The Isala, increased by the waters of the Rhine, flowed northwards into a great lake called Flevo, on issuing from which it became a river again, and fell into the ocean after forming an island of the same name. (Mela, iii. 2.) In course of time the sea made great inroads upon the land round the mouth of this river, till at length it submerged that part of the country, and became united with the lake Flevo, thus forming the modern Zuider Zee.

(Ukert, *Geographie der Griechen und Römer*, vol. ii., part. ii., p. 147, &c.)

RHINE, circles of the Upper, Middle, and Lower Rhine in the grand-duchy of Baden. [BADEN.]

RHINE, THE CIRCLE OF THE, in the kingdom of Bavaria (now the PALATINATE), is entirely detached from the rest of the kingdom, and lies on the left bank of the Rhine. It is composed of the greater part of the French department of Mont Tonnerre and small portions of those of the Lower Rhine and the Saar, which were taken from France in 1814, and assigned by the Congress of Vienna to Austria, which made the country over to Bavaria. It is bounded on the north-west by Rhenish Prussia, on the north by Rhenish Hesse, on the east by Baden, from which it is separated by the Rhine, and on the south by France, Rhenish Prussia, Coburg, and Hesse Homburg; the area within these limits, according to the 'Military Topographical Atlas' (as Hassel, 1819, states), is 140 German or 2940 English square miles. But Schlieben (1831), Hörschelmann (1834), and Cannabich (1836), all agree in making it 100 German or 2100 English square miles. The 'Weimar Almanach' of 1840 follows Hassel. The circle is very mountainous, being traversed by branches of the Wasgau (the Vosges); but there are some beautiful valleys and plains, and the country is very fertile and well cultivated. The mountains are for the most part covered with forests; very few are quite bare; the south sides, at least, being everywhere covered with vines. The principal river is the Rhine. All the other streams are tributaries to the Rhine; the chief of these are the Lauter, which forms the boundary towards France; the Queich, the Speyerbach, and the Nahe. Agriculture is carried to a high degree of perfection, and the products are corn of all kinds, pulse, flax, hemp, tobacco, madder, and hops. Fruit is very extensively cultivated, and the inhabitants derive very large profits from the walnuts and chestnuts. The best wines are produced on the Rhine; some sorts are in good repute; the greater part is consumed in the country. Though agriculture is the chief occupation of the inhabitants, there are flourishing manufactures of wool, cotton, and hardware. The population is 565,345, of whom the majority are Roman Catholics; the remainder are Protestants. [DEUX PONTS; LANDAU; SPEYER.]

RHINELLA, Fitzinger's name for a genus of Frogs, *Oxyrhynchus* of Spix. [FROGS, vol. x., pp. 494-496.]

RHINO'CEROS (the Greek *ῥινόκερως*), the name of a genus of pachydermatous quadrupeds, placed by Linnæus in his order *Bruta*; and by Illiger in his order *Multungula*, family *Nasicornia*. It has been a question whether one of the species, *Rhinoceros unicornis*, Linn. (*Rhinoceros Indicus*, Cuv. and Desm.) is not the ראם (*Reem*) or רים (*Rem*) of Scripture (*Numb.* xxiii. 22, xxiv. 8; *Deut.*, xxxiii. 17; *Job*, xxxix. 9, 10; *Psalms*, xxii. 21; xxix. 6; xcii. 10; *Isaiah*, xxxiv. 7).

In the Septuagint the word is translated *μονοκέρως* (*Monoceros*, or *Unicorn*), except in Isaiah, where it is rendered ἁδροὶ (*Hadri*, or *the mighty or powerful ones*).

In the Tigurine and Vulgate versions the word is rendered (*Numb.*, xxiii. 22; *Job*, xxxix. 9, 15) *Rhinoceros*, with a note to the former, that others read *Monoceros*; and in Scheuchzer's *Physica Sacra* we have (tab. 313) *Numb.*, xxiii. 22, illustrated by a somewhat extravagant and exaggerated figure of a one-horned Rhinoceros, with 'Reem: *Rhinoceros*' below the plate.

In the Bible 'Imprinted at London by Robert Barker, Printer to the King's most excellent Maiestie' ('Breeches' Bible) the word used is 'Unicorne,' and 'Unicorn' is the expression in the version now in use in our churches.

Some are of opinion that the *Reem* or *Reïm* of Scripture were savage animals of the Bovine genus, and others that the word signified the *Oryx*, observing that *Reem* is the Arabian name for a species of wild goat or gazelle. These allege that the *Reem* was two-horned (*Deut.*, xxxiii. 17; *Psalms*, xxii. 21.) The better opinion seems to be that the animal or animals intended to be designated in most of the passages quoted, if not in all, was or were the *Rhinoceros Unicornis*, or *Great Asiatic one-horned Rhinoceros*. M. Lesson expresses a decided opinion to this effect; and indeed the description in *Job* (chap. xxxix.) would almost forbid the conclusion that any animal was in the writer's mind except one of surpassing bulk and indomitable strength.

The impotence of man is finely contrasted with the might of the Rhinoceros in this description, which would be overcharged if applied to the less powerful animals above alluded to.

It has also been doubted whether accounts of the Indian ὄνοι ἄγριοι (Wild Asses) given by Ctesias (*Indic.*, ed. Bähr) were not highly coloured and exaggerated descriptions of animals of this genus, and whether the ὄνος Ἰνδικός (Indian Ass) of Aristotle was not a Rhinoceros.

The account of Ctesias is evidently tinged with fable; but there are parts of it which suit well with the habits of a Rhinoceros. He describes his *Wild Asses* as being as large as horses, and larger, with white bodies, red heads (*πορφυροῖ*), and blue eyes (*κυανέους*), having a horn on the forehead a cubit long, which for the extent of two palms (*παλαιστάς*) from the forehead is entirely white; above it is pointed and red (*φοινικοῦν ἐρυθρὸν πάνυ*), and black in the middle. Of this horn drinking-cups are formed, and those who use them are said not to be subject to spasm (*σπασμῷ*) nor epilepsy (*ἱερᾷ νόσῳ*), nor to the effects of poison, provided, either before or after taking the poison, they drink out of them wine or water or any other liquid. Other asses, whether wild or domesticated, have no astragalus, neither have the other wild solipedes (*μώνυχα*); but these have an astragalus and a gall-bladder? (*χολὴ ἐπὶ τοῦ ἥπατος*). 'Their astragalus,' adds Ctesias, 'which I have seen, is very beautifully formed (*κάλλιστον*), in figure and size like that of an ox, heavy as lead, and red throughout like cinnabar. This animal is very swift and very strong. Neither a horse nor any other pursuer can overtake it. It begins its progress slowly, increasing in speed as it goes on, and runs quicker and faster. They are not naturally ferocious, but when they first lead forth their little young ones to graze, and are surrounded by many horsemen, they are unwilling to fly and leave their young, but fight with horns and heels (*λακτίσμασι*) and teeth (*δήγμασι*), killing many horses and men. They are also destroyed by arrows and javelins, for they are not to be taken alive. The flesh is not eatable by reason of its bitterness, but the animals are hunted for the sake of the horns and astragali.'

It is not at all improbable that these parts, so much sought after on account of supposed virtues, underwent some process by which they were artificially coloured in the manner above described.

Aristotle, who (lib. viii., c. 28) speaks of Ctesias as not being worthy of credit, notices (lib. ii., c. 1) the *Ἰνδικὸς ὄνος* (Indian Ass). He observes that he has never seen a one-horned solidungulous animal; but there are a few which are monoceratous and solidungulous, such as the one-horned Indian ass (*Ἰνδικὸς ὄνος μονόκερως*), and that it is the only one of the solidungulous animals which has an astragalus.

Agatharchides describes the one-horned Rhinoceros by name, and speaks of its ripping up the belly of the Elephant. (*Phot. Bibl.*, col.) This is probably the earliest occurrence of the name *Rhinoceros*.

The rhinoceros which figured in the celebrated pompa of Ptolemy Philadelphus was an Ethiopian, and seems to have marched last in the procession of wild animals, probably on account of its superior rarity, immediately after the camelopard, and before the wain carrying Bacchus fleeing to the altar of Rhea from the persecution of Juno. (Athenæus, *Deipn.*, v., c. xxxii.)

Dion Cassius (lib. li.) speaks of the rhinoceros killed in the circus with a hippopotamus in the show given by Augustus to celebrate his victory over Cleopatra; and says that the hippopotamus and this animal were then first seen and killed at Rome. If the rhinoceros was one-horned, as it appears to have been from his description, he was certainly wrong as to the sight at least; for Pliny (*Hist. Nat.*, viii. 19), alluding to the games of Pompey the Great, remarks, 'iisdem ludis et rhinoceros unius in nare cornu, qualis sæpe visus;' and probably equally wrong as to the killing, for upon great occasions few animals left the arena alive, and Pompey was not likely to have risked his popularity by baulking the Roman appetite for blood. It is not improbable that the rhinoceros slain upon the occasion of the victory of Augustus with the hippopotamus was African, and two-horned. If so, Dion would be right; for it does not appear that a two-horned rhinoceros had ever been either seen or slain previously.

The rhinoceros so clearly described by Strabo (lib. xvi., p. 774) as seen by him, was one-horned. The folds of the skin are distinctly alluded to: that noticed by Pausanias (lib. ix., c. 12) as 'the bull of Ethiopia' was two-horned, and he describes the relative position of the horns.

Mr. Wood (*Zoography*) gives an engraving of the coin of Domitian (small Roman brass) on the reverse of which is the distinct form of a two-horned rhinoceros: that coin which, with the epigram of Martial, has so puzzled antiquaries, and led some of them astray, when a very little knowledge of natural history would have kept them in the right road.

'The exhibition of the two-horned Rhinoceros to the Roman people, probably of the very same animal represented on the coin,' says Mr. Wood, 'is particularly described in one of the epigrams attributed to Martial' ('De Spectaculis Libellus,' *Ep.* xxii.), 'who lived in the reigns of Titus and Domitian.'

The following are the lines:—

> Sollicitant pavidi dum rhinocerota magistri,
> Sæpe diu magnæ colligit ira feræ.
> Desperabantur promissi prælia Martis:
> Sed tamen is rediit cognitus ante furor.
> Namque gravem *gemino cornu* sic extulit ursum,
> Jactat at impositus taurus in astra pilas.

'By this description it appears that a combat between a rhinoceros and a bear was intended, but that it was very difficult to irritate the more unwieldy animal, so as to make him display his usual ferocity; at length however he tossed the bear from his double horn, with as much facility as a bull tosses to the sky the bundles placed for the purpose of enraging him. Thus far the coin and the epigram perfectly agree as to the existence of the double horn; but unfortunately commentators and antiquaries would not be convinced that a rhinoceros could have more than one horn, and have at once displayed their sagacity and incredulity in their explanations on the subject. Hence we find a similar coin engraved in the second volume of Cooke's "Medallic History of Rome," where the animal is misrepresented, and particularly the horns, which appear like tusks, bending in different directions. After quoting the lines of Martial, Mr. Cooke observes, that it is the opinion of Bochart that the disputed line should be read thus:—

> Namque gravi geminum cornu sic extulit ursum.

By which alteration we should have two bears instead of one;* but Mr. Cooke proposes to omit only one letter, the *s* in the word ursum, by which means he turns the bear into a wild bull; and as it is perfectly natural that the wild bull, or urus, should have two horns, he translates the line thus:—

* And also a piece of bad Latin.

Struck with amazement, we beheld upborne
The buffal dreadful with his double horn.

If Cooke had seen the coin himself, or had consulted that book so useful to a medallist, the "Catalogue of Dr. Mead's Coins," he would not have deprived the epigram of its original and curious information.'

Two at least of these two-horned rhinoceroses were shown at Rome in the reign of Domitian.

The emperors Antoninus, Heliogabalus, and Gordian also exhibited Rhinoceroses, and Captain W. H. Smyth, R.N., noticing a coin of the emperor Philip (large brass), speaks of a noble lion on the reverse as representing one of the *Leones Mansueti* mentioned by Capitolinus. 'It seems,' says Captain Smyth, speaking of the *Sæculares Augustorum* (the legend on the reverse), 'that there were provided no fewer than 32 elephants, 10 tigers, 10 elks, 60 lions, 30 leopards, 1 hippopotamus, 1 rhinoceros, 40 wild horses, 20 wild asses, and 10 camelopards, with a vast quantity of deer, goats, antelopes, and other beasts. And still further to increase the public *hilarity*, 2000 gladiators were matched in mortal affray.' (*Descriptive Catalogue of a Cabinet of Roman Imperial large Brass Medals.*)

Cosmas speaks expressly of the Ethiopian Rhinoceros as having two horns and of its power of moving them.

The first Rhinoceros seen by modern Europeans appears to have been a *Rhinoceros unicornis*, Linn., sent from India to Emmanuel, king of Portugal, in 1513. Emmanuel sent it as a present to the pope, but the animal in an access of fury sunk the vessel on its passage. A sketch of the animal was sent from Lisbon to Nürnberg for Albert Dürer, who engraved the extravagant figure from which those of Gesner, Aldrovandi, Jonston, and Scheuchzer were taken. Among other monstrosities, the animal, which is represented as if it were clad in offensive and defensive armour, has a second small horn projecting from the top of the shoulders. A reduced copy of the same figure is given in the early edition of Petiver. In 1656 we find in the *Catalogue of the Musæum Tradescantianum* (sect. ii., '*Four-footed* Beasts, *with some Hides, Hornes, Hoofs*')—

$$\text{`The Rhinoceros}\quad .\quad \begin{cases}\text{horn.}\\ \text{jaw-bone.}\\ \text{back-bone.'}\end{cases}$$

In 1685 one was brought alive to England; another was shown throughout a great part of Europe in 1739; and a fourth, a female, in 1741. The Rhinoceros of 1739 was described and figured by Parsons (*Phil Trans.*, xlii.), and he also mentions that of 1741, which animal Cuvier believes to be the same that was shown at Paris in 1749, painted by Oudri, and afterwards engraved by Edwards (*Gleanings*), and that figured by Albinus. It was certainly that described by Daubenton, and the subject of the observations of Meckel. The Rhinoceros whose osteology is described by Cuvier was the fifth that had come to Europe. It arrived at Versailles in 1771, being then very young, and Buffon notices it in his supplement. This animal died in 1793, at the age of 25 or 26. In 1790 a Rhinoceros was brought from the East Indies to this country as a present to Mr. Dundas, who gave the animal away. It was afterwards purchased by Pidcock for 700*l.*, and was exhibited at Exeter Change and about the country. A seventh, very young, destined, it is said, for the menagerie of the emperor of Germany, arrived from the Indies in 1800, and died in London soon after its arrival: this animal was dissected by Mr. Thomas, who published his observations in the *Philosophical Transactions*. An eighth, which afterwards went to Germany, was seen at Paris not many years ago. All these were one-horned. Of late years several of the same species (*R. Indicus*) have arrived in London: one of these, a very fine healthy animal, was bought by the Zoological Society of London, and is now (January, 1841) alive in their gardens in the Regent's Park.

No two-horned Rhinoceros seems to have been brought alive to Europe in modern times. Indeed, up to a comparatively late period, this form was known only by the horns which were preserved in museums, nor did voyagers give any sufficient details to impart any clear idea of the form of the animal. The rude figure given by Aldrovandi (to whom it was communicated by Camerarius), in his chapter *De Asinis Cornutis* (published in 1639), leaves no doubt that, wretched as it is, it must have been taken from a two-horned Rhinoceros. This is copied by Jonston (pl. xi.), who has given the animal the head of an ass or mule garnished with a couple of horns, and a flowing tail in order to make it more asinine. The collar, too, is made much more smart. These are the two earliest modern figures of a two-horned Rhinoceros known to us. Dr. Parsons endeavoured to show that the one-horned Rhinoceros always belonged to Asia, and the two-horned Rhinoceros to Africa: but, as we shall presently see, there are two-horned Rhinoceroses in Asia as well as in Africa. Flacourt, in his *History of Madagascar*, states that he saw one in the Bay of Soldagne, near the Cape of Good Hope, at a distance. Kolbe and others always considered the Rhinoceros of the Cape as two-horned: but Colonel Gordon seems to be the first who entirely described the species with any exactness, and his description was given by Allamand in the supplement of the Dutch edition of Buffon. Sparrman gave a very detailed description of the Cape Rhinoceros in the *Transactions of the Swedish Academy* (1778), and in his *Voyage*. The description, to which we shall hereafter refer, is accompanied by sufficiently accurate figures, though that of the animal is stiff and ill-designed. At this period it was well known that the Cape species was not only distinguished by having two horns from the Indian Rhinoceros then known, but also by the absence of the folds of the skin so remarkable in the latter. Camper, in his treatise on the two-horned Rhinoceros, not only confirmed Sparrman as to the point o. the Rhinoceros of the Cape having 28 molar teeth, but also the statement of Dr. Parsons and Daubenton, that the Indian species has the incisors separated from the molars by a wide space.

Miller (Pennant, *Quadrup.*) had already noticed a Sumatran Rhinoceros, when Mr. W. Bell published, in the 'Philosophical Transactions' (1793), his account of a Rhinoceros of Sumatra apparently intermediate between that of the Cape and the Indian species already known; for whilst this species has two horns, and the skin but little folded, resembling in these points the Rhinoceros of the Cape, an interval intervenes between its incisors and molars, as in the Indian one-horned Rhinoceros; and it also has the small intermediate incisors below.

The observations of MM. Diard and Duvaucel confirmed the strong suspicion entertained by Cuvier, that the one-horned Rhinoceros, or *Badak* of Java, is a different species from the one-horned Indian species so long and so well known.

It now becomes necessary to notice the carelessness, to call it by the mildest name, of Bruce, who gave to the world a representation of a two-horned Rhinoceros from Abyssinia, with a strongly-folded skin. The truth appears to be, that the body of the animal figured by Bruce was copied from that of the One-horned Rhinoceros given by Buffon, to which Bruce added a second horn. Salt proves that the Abyssinian Rhinoceros is two-horned, and that it resembles that of the Cape. Mr. Burchell (1817) published a good and faithful account of a second species of African Rhinoceros, under the name of *Rhinoceros simus;* and Dr. Andrew Smith has added a third, to which he assigns the specific name of *Keitloa.*

ORGANIZATION.

Skeleton.—The bony framework of the animal of this genus approximates to that of the *Hyrax*, the Tapirs, and the Horse among living genera. Though a general resemblance pervades the entire skeleton of the animals of this genus, there are certain differences, in the skull especially, which render it adviseable to notice certain of the species separately with regard to their osseous structure. All the species have seven molar teeth on each side, both in the upper and under jaw; but the species differ as to the incisors.

Rhinoceros Indicus. (*Rhin. Unicornis*, Linn.)

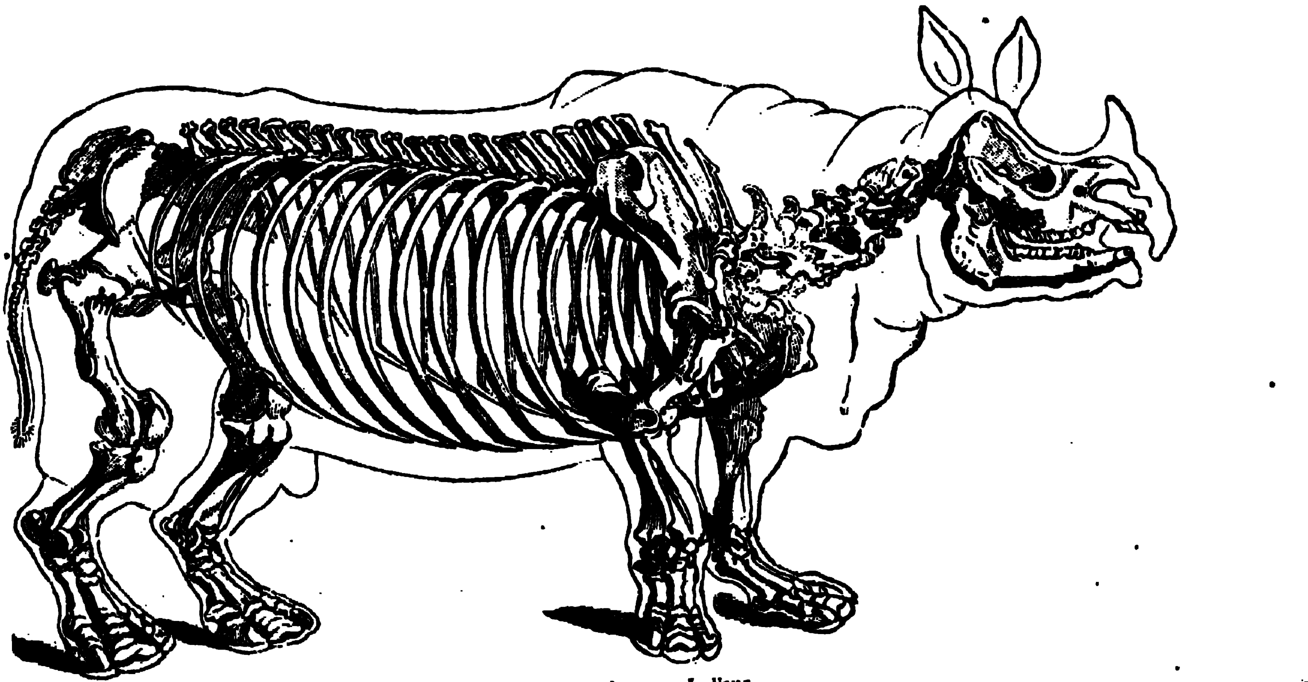
Dental Formula:—Incisors $\frac{4}{4}$; Canines 0; Molars $\frac{7-7}{7\ \ 7}$; $= 36$.

Skull.—The pyramidal elevation of the cranium is the first point that strikes the observer on viewing the skull of the *Rhinoceros Indicus*. The next remarkable parts are the *ossa nasi*, which are of a size and thickness without example among quadrupeds: these form an arch or vault, which overhangs what may be termed the incisive bones, and gives support to the horn, forming, with the parts of the maxillary bones which carry the incisives, the great nasal notch which distinguishes the skull of these animals. Hence three pairs of bones, the nasal, the incisive, and the maxillary, contribute in the Rhinoceros to form the contour of the external apertures of the nostrils; whilst, with the exception of the Tapir, the two first only are employed for this purpose in the other quadrupeds. The form of the molar teeth varies but little from that which characterises those of other species. The upper incisors are very much compressed, and placed obliquely at a very considerable angle: the lower incisors are large, pyramidal, and pointed, and between them are two very little incisors, which are supposed never, or hardly ever, to cut the gum. There are also two little incisors on each side of the two upper great ones; but these are, on the contrary, on the outside of the large incisor-teeth. The form of the lower incisor teeth reminds the observer of the instrument generally used by husbandmen for extracting *Docks* (*Rumex*) from their pastures, and they appear to be calculated for uprooting plants, as well as tearing or stripping up branches or stems of shrubs or trees. In the case of uprooting, the nipper-like operation of the two great upper incisors, as opposed to the lower ones, would materially assist the extraction.

The number of molar teeth on each side often varies in different individuals, though there are never more than twenty-eight. The reason of this is well explained by Cuvier.

'All herbivorous animals,' says Cuvier, 'beginning with the horse, wear their teeth to the root; because in proportion as the crown diminishes by trituration, the alveolus is filled, and pushes the root out. When this tooth is composed of two branches, as in the Rhinoceros, and the body of the tooth is entirely used, there remain two stumps of root: these stumps are shed one after the other, being constantly diminished by the trituration, and pushed out by the growth of bone in the interior of the socket. In time the sockets themselves disappear. This is what happened to our Rhinoceros' (the Paris skeleton of *Rhinoceros Indicus*); 'he had already lost his first molar on each side, and the alveoli of it were nearly effaced; he had worn the next molar to the root, and had on one side lost even one of the stumps of the root, whilst both the stumps of the other side remained. But if this Rhinoceros had lost molars by age, he had not gained incisors: that happens not to the Rhinoceros more than to other animals who grow old. The two small intermediate incisors of the lower jaw exist from the period of youth, as may be seen in the head given to the cabinet by M. Adrian Camper; and still better by the end of the lower jaw of a very young subject, designed by his father, in the "Acta Petropolitana" for 1777, and given here after nature: but they always remain hidden under the gum, and this is the reason why Meckel did not see them in the living animal, whilst they are manifest in the skeleton. Mr. Thomas, a surgeon of London, who has published some anatomical observations on the One-horned Rhinoceros, also found these small teeth in the skeleton of an individual four years old. But what no one, to my knowledge, has yet published, is that the Rhinoceros has, at a certain period of its life, two similar incisors on the upper jaw; only they are on the outside of the large ones, whilst in the lower jaw they are between the large ones. This might have been inferred from the figure of the intermaxillary bone of a very young Rhinoceros, given by Camper (the father) in the "Acta Petropolitana," vol. i., pl. ix., fig 3, and which I reproduce more complete, pl. v., fig. 3. I even thought once that this character necessarily indicated another species; but in examining the drawings of the anatomy of our Rhinoceros, made with the greatest care by Maréchal, under the inspection of Vicq. d'Azyr and Mertrud, I discovered the figure of a very small tooth outside the great incisor of the right side; and I saw in the explanation which accompanies the drawing, and which is written by Vicq. d'Azyr with his own hand, that there was, in fact, a small tooth on this side which was wanting on the other; I ran to the skeleton, and there found the remains of the alveolus on one side; but the tooth, already too much loosened (déracinée), was lost during the maceration; on the other side the alveolus itself was effaced.' (*Ossemens Fossiles.*)

There are 56 *vertebræ* in all—7 cervical, 19 dorsal, 3 lumbar, 5 sacral, and 22 coccygian. The transverse apophyses of the atlas are very great and very wide, and without obliquity, so that their contour is nearly rectangular, which distinguishes them from those of the Hippopotamus; their extreme size distinguishes the atlas of the Rhinoceros from that of the Elephant still more clearly. The spinous process is only a large tubercle, and below the body of the vertebra is a small longitudinal crest. There are nineteen pairs of ribs, seven of which are true: they are easily recognised by their proportional thickness and the great arch formed by their curvature. The first pair are soldered together below. The sternum in the adult is composed of four bones; the first is compressed into a ploughshare-shape, and projects in a point in front of the first rib



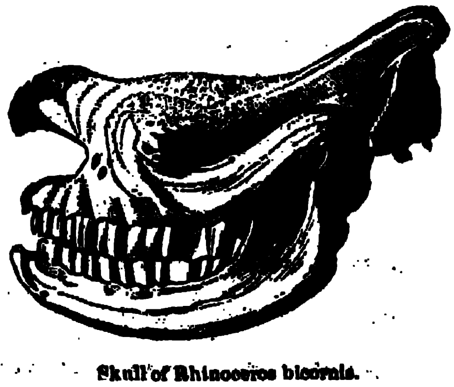
Skeleton of Rhinoceros Indicus.

Of the *anterior extremities* the following parts are remarkable. The *scapula* is oblong; its greatest width is at its upper fourth; its posterior border is elevated and thickened at this point. The crest has a very projecting apophysis at its upper third, directed a little backwards; this crest terminates at the lower fourth of the scapula, and consequently there is no acromion; a tuberosity occupies the place of a coracoid process, and the glenoïd cavity is nearly round. This configuration distinguishes the scapula or blade-bone of the Rhinoceros from that of other great quadrupeds; that of the Elephant, for example, forms a nearly equilateral triangle, and the spine a great recurrent apophysis. The widely crested *humerus* is very remarkable, and distinguishable from that of every other quadruped of the same size, but the carpus is formed after the same model as that of the Tapir and the Horse; though the Rhinoceros and the Tapir resemble each other more than they respectively resemble the horse in this part of the skeleton. The anterior face of the semilunar bone is square, and not pointed above, as in the Hippopotamus. None of the bones of the anterior extremities are liable to be confounded with those of animals of the same size, and though their greatest resemblance is to those of the Tapir, the smallness of those of the latter makes a sufficient distinction.

The *posterior extremities* present the following remarkable parts. The *pelvis* is extremely wide, and that of the Elephant alone among living quadrupeds resembles it; but the pelvis of the Rhinoceros is at once distinguished by its forked spine. The angle of the *os ilium*, which reaches the sacrum, is besides more elevated, and its neck much longer and narrower.. The external edge of this bone is nearly as great as the internal, whilst in the Elephant it is much smaller. The crest of the *pubis* commences from the top of the ossa ilii. The *oval holes* are wider than they are long. The tuberosity of the *ischium* is very large above, and in the form of a hook. The *femur* is, if anything, more remarkable than the *humerus;* its upper part is extremely flattened from before backwards; the eminence which Cuvier calls the third trochanter, projects extremely, and forms a hook, which ascends to touch a hook descending from the ordinary grand trochanter, so that there is an oval hole between these two eminences. The *tibia, fibula, tarsus*, and the upper part of the *metatarsus* are constructed upon the plan of those of the horse; but the pulley of the *astragalus* is wider, more oblique, less deep, and its posterior internal angle is obliquely truncated; the astragalus touches the *cuboïd bone* by a rather wide surface; the *scaphoïd* and the third *cuneiform bones* are less flattened; the second *cuneiform* and the *cuboïd* larger. In these points the Rhinoceros resembles the Tapir more than the Horse, and indeed were it not for size would be hardly distinguishable from the former; but it differs from both in having a larger and stouter *calcaneum*. Its anterior or astragalian surface is triangular. The *astragalus* has two large facets; that of the inside is prolonged into a tail-like process all along the lower edge of this surface, as in the Tapir. In the Horse the third facet towards the external angle is distinct. The facet, which touches the cuboïd bone, is very small. The *cuboïd bone* has a long and large protuberance behind, which does not exist in the Horse. On the inside of the foot is a similar one, produced by a supernumerary bone attached to the scaphoid, the internal cuneiform and the internal metatarsial bones, which represents at once the first cuneiform and the thumb in its entirety. This bone exists only in the Tapir and in the Horse; but in the latter it is promptly soldered to the second cuneiform bone. The scaphoïd bone then has three articular facets on its inferior or rather metatarsial face; the third cuneiform or internal bone is much smaller than the other. The *phalanges* are all wider than they are long; the second phalanx of the middle toe is especially short. The last are channelled like those of the hoof of a horse. (Cuv.)

In comparing the osteology of the Two-horned Rhinoceros (*Rhinoceros Africanus*) of Africa and *Rhinoceros simus* with that of the One-horned Rhinoceros of Java and that of the One-horned Rhinoceros of India, and the relations of the osseous parts of those species to each other, we commence with

The Two-horned Rhinoceros of the Cape.—The following differences appear on examining the skull:—I. On its upper surface the horizontal contour of the bones of the nose is rounded in the Cape species, and almost extravagantly so in *Rhinoceros simus*, whilst in the one-horned species it is pointed. A deep furrow marks their suture in the first. The space between the post-orbital apophyses is convex in *Rhinoceros Africanus*, or *Bicornis*, transversely concave in *Rhinoceros Indicus*. From this point up to the occipital crest the skull of *Rhin. Africanus* appears longer, because this crest is directed obliquely backwards, whilst it is vertical in *Rhin. Indicus*. The temporal fossæ are less approximated in *Rhin. Africanus*, which leaves the upper and truncated part of the occipital crest wider. The zygomatic arches are less separated backwards in *Rhin. Africanus*, whilst in *Rhin. Indicus* they form a salient angle, which, joined to the difference of the bones of the nose, makes the general horizontal contour of the skull of *Rhin. Indicus* triangular, whilst that of *Rhin. Africanus* and *Rhin. simus* is oblong. The skull of the latter agrees generally with that of *Rhin. Africanus*, but the bones of the nose are prodigiously wide and flattened in front. II. The principal differences in the profile relate to the form of the incisive bones, which in *Rhin. Indicus* advance as far as the bones of the nose, and have above a particular apophysis: in *Rhin. Africanus* and *Rhin. simus* the incisive bones are each reduced to a small oblong piece. Again, a principal difference exists in the convexity of the suborbital space of the skull of *Rhin. Africanus* and *Rhin. simus*, already noticed with regard to the upper surface; and also in the elevation of the occipital crest of *Rhin. Indicus*, and its low position in *Rhin. Africanus* and *Rhin. simus*, whence it results that at an equal distance between the occipital condyles and the muzzle, *Rhin. Indicus* has the upper part of the skull much shorter than *Rhin. Africanus* and *Rhin. simus*. III. On the lower surface, besides the differences which result from the form of the zygomatic arches, the direction of the occipital crest, and that which the difference of the incisive bones produces on the front of the palate, it may be observed that the series of molars is longer in *Rhin. Africanus* and *Rhin. simus*, and that it converges anteriorly with that of the opposite side. In *Rhin. Indicus* the two rows of molars are parallel or nearly so: the palatine notch is pointed anteriorly in *Rhin. Africanus*, and rounded in *Rhin. Indicus;* in both it advances to the penultimate molar: the basilary region is longer in *Rhin. Africanus*, so that it gains in length behind what it had lost before. IV. The posterior surface; which is demi-elliptical, and higher than it is wide in *Rhin. Indicus*, and rather wider than it is high in *Rhin. Africanus* and *Rhin. simus*, in which last the occipital foramen is wider than it is high; whilst in *Rhin. Indicus* those proportions are reversed. The principal differences of the lower jaws are (besides the length which precedes the molars, which is much less in *Rhin. Africanus* and *Rhin. simus* than in *Rhin. Indicus*), 1st, that the series of molars is longer in the African species; 2nd, that the rising branches are much less high; 3rd, that the coronoid apophyses are much shorter, less pointed, and less directed forwards; 4th, that the dental branches are much more convex externally. The upper molars of the African species taken separately are much larger than those of the two one-horned species, and may be distinguished because their posterior border being less elevated, the notch of this border does not change into a fosset, as in the two one-horned species, but remains a true notch, at least till the tooth is worn to a certain extent. There are also other differences in the bones of the anterior and posterior extremities of *Rhin. Africanus*, which our limits will not permit us to detail, but which are pointed out by Cuvier,* who has noticed the other differences above alluded to, excepting those relating to *Rhin. simus*, and which will be obvious on an inspection of the skeleton.



Skull of Rhinoceros bicornis.

The One-horned Rhinoceros of Java (*Rhinoceros Javanus*) resembles less, in the bones of the extremities, the *Rhinoceros Indicus*, than does the *Rhinoceros Africanus;* which, as Cuvier observes, is remarkable. But in the skull the resemblance to that of *Rhinoceros Indicus* is striking, though there are still remarkable differences. The whole cranium, for instance, is less, and the zygomatic arches, the orbits, and the nasal bones, which terminate in a sharp point, are less developed. The post-orbital apophysis can hardly be traced. The occipital crest is less elevated; there is no apophysis on the superior edge of the incisive bones; the orbit has a more forward position; the posterior base of the zygomatic arch is less approximated to the occiput; the region of the external opening of the ear is wider; the descending part of the occipital arch, which is trenchant in *Rhinoceros Indicus*, is here stout and obtuse. The posterior surface of the skull of *Rhinoceros Javanus* is wider than it is high: in *Rhinoceros Indicus* it is just the reverse; and the same difference exists in the dimensions of the occipital hole. Cuvier further observes that the upper contour of the occipital crest is notched in the cranium of the skull of *Rhinoceros Javanus* in the Paris collection, and convex in that of *Rhinoceros Indicus*. On examination of the lower surface, the incisive bones of the Javanese skeleton were found by Cuvier to be narrower. The posterior notch of the palate was less deep, and advanced nearly opposite to the antepenultimate molar; the vomer was more visible externally in the internal nasal fossa; the pterygoid processes were less approximated at their base; the basilary region was shorter and wider, &c.; the ascending *rami* of the lower jaw and the coronoïd apophysis were much less, but in other respects the structure resembled that of *Rhinoceros Indicus*. Cuvier thought at first that the small external upper incisors did not exist, but the observations of MM. Diard and Duvaucel satisfied him that they did.

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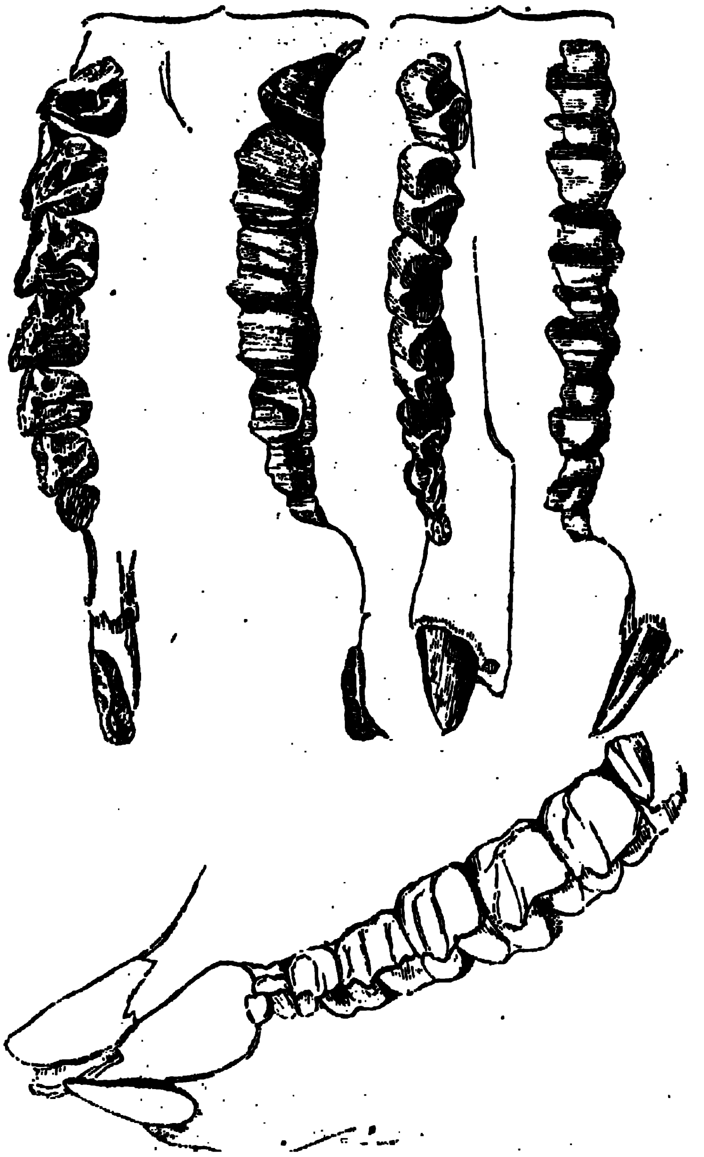
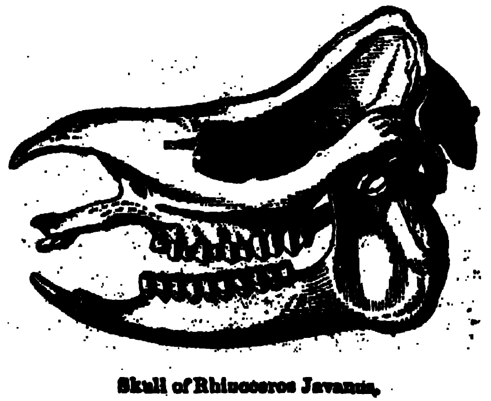
* But Cuvier observes that these differences (with the exception of those of the head and teeth) are of such little importance that he would not affirm of one of them that it might not exist as well between two individuals of *Rhin. Indicus* as between *Rhin. Indicus* and *Rhin. Africanus;* nor would he venture to found a specific character on one of them taken by itself.



Teeth of Rhinoceros Javanus. (F. Cuv.)



Skull of Rhinoceros Javanus.

Cuvier found the great upper incisors more delicate, so to speak, and situated more in parallel with each other than those of *Rhinoceros Indicus*: the lower incisors were in the form of a triangular pyramid, terminated forwards in a sharp point, with their lower edge rounded, and their upper surface worn by the friction of the upper incisors. Cuvier justly supposes that the difference between these great lower incisors, which were sharp and pyramidal, as he has well described them, in the Javanese species, and the truncated great lower incisor teeth of *Rhinoceros Indicus*, was the consequence of age only. The small intermediate incisors in the Javanese species were like those in *Rhinoceros Indicus*. There is not much difference between either the upper or the lower molar teeth of the two one-horned Asiatic species; but the scapula of the Javanese Rhinoceros is very different from that of *Rhinoceros Indicus;* for it is wider in the middle; it has the anterior edge rounded into a more convex arch; the salient angle of the spine has a much higher position, it is wider and, especially, longer, directed backwards on the plane of the bone, and so that its point answers to the posterior border. It is also much lower below, and the coracoïd tubercle is much larger than that of *Rhin. Indicus*. Cuvier further remarks that the *humerus* of *Rhin. Javanus* is distinguishable at the first glance by its bicipital obliquely hollowed canal, and other differences; the *ulna* is narrower below, and the olecranon is more elongated and directed more according to the axis of the bone: the *radius* exhibits but little difference. The bones of the *carpus* were found to resemble those of *Rhin. Indicus* more than those of *Rhin. Africanus;* with the exception of the unciform bone, which is higher in proportion. Cuvier found that the pelvis of *Rhin. Javanus* differed from that of the other species principally in having the external spine not forked. There is a slight difference in the femur, principally in what Cuvier terms the third trochanter, which is placed on the middle of its external side, is wide, curved forwards, but not ascending towards the great trochanter, which has no point to meet it. The notch or space formed by the two is not closed, in consequence, externally; but it is as large as in *Rhin. Indicus*. The lower head of the bone is widened backwards. Cuvier found the principal difference of the *tibia* to consist in its greater length and the depth of the anterior canal of the upper head of the bone. But the tarsal bones were found by Cuvier to exhibit very marked specific differences: the *astragalus*, below its anterior pulley, has an oval deep fossa which is wanting in the other species. The internal edge of the pulley is also shorter, and descends more obliquely forwards. The lower apophysis of the calcaneum is less stout in proportion. The cuboid bone is less elevated, and all the bones of the metatarsus are shorter, wider, and more flat; so that, as Cuvier remarks, the feet of this species must be shorter and wider in proportion than the others.

Before we close our short notice of the osteology of this genus, we must refer the reader to the *Catalogue of the Contents of the Museum of the Royal College of Surgeons in London*, part iii.; and to the Museum itself for a fine collection of the osseous parts and horns of these animals, Nos. 813 to 839 inclusive. Among them will be found a skeleton of the Sumatran Two-horned Rhinoceros (Sir Stamford Raffles), and the very skulls of that species which were figured by Bell (*Phil. Trans.*, vol. lxxxiii., pl. 2, 3, 4 (No. 1815). There are also good examples of *Rhin. Indicus* and a very fine skull of *Rhin. simus* from the collection of Mr. Delafons.

Digestive Organs.—The stomach of these animals is simple, their intestines very long and the cæcum very large. Sparrman, who dissected a Cape Two-horned Rhinoceros as well as his position and his Hottentot assistants would permit, remarks that the viscera most resemble those of a horse; though the stomach did not in the least resemble that of a horse, but rather that of a man or a hog. It was four feet in length and two feet in diameter; and to this viscus was annexed an intestinal tube twenty-eight feet in length and six inches in diameter: at three feet and a half from the bottom was a large cæcum, 'if' says Sparrman, 'I may so call a viscus, which at its upper end was of the same width as the stomach, viz. two feet, and above twice the length, that is, eight feet and a half, and lay on the spine of the back, being attached to it at both ends, after which it was contracted into a rectum six inches in width and eighteen in length.' The liver was three feet and a half in breadth, but in depth (taken as if the animal were in a standing position) two feet and a half. It consisted of three larger and perfectly distinct globes, almost equal in size, and of a small lobe besides, which projected to about a foot from the concave side of the liver, at the middle of its upper edge. There was no gall-bladder nor any trace of it. In this the structure of the Rhinoceros resembled that of the horse; though some have considered the large hepatic duct of the horse as a gall-bladder. The contents of the stomach, which was very much distended, were entirely without offensive smell, and perfectly fresh and sweet, consisting of masticated roots and small branches of trees, some of them as big as the end of a man's finger. There was evidence that the animal had also eaten a great quantity of succulent plants, among which Sparrman thought he recognised two or three which were harsh and prickly. 'The whole of this mass,' says he, 'diffused around a very strong and not disagreeable aromatic odour, which in a great measure took off the stench of the putrid viscera. Might it not be some peculiar herb, or, perhaps, the root only of an herb, with which I was entirely unacquainted, that produced the greatest part of the aromatic flavour? In the excrements of this animal, which were four inches in diameter, and in other respects resemble those of a horse, though they are of a much drier nature, there is usually seen a quantity of bark and fibres of trees, a circumstance that the hunters pay attention to; and by that means are able to distinguish it from the dung of the Hippopotamus, an animal that feeds only on grass. I thrust my hand into this creature's mouth, which was half open, and found the tongue perfectly soft, which is in direct contradiction to the common notion, viz. *quod lambendo trucidat*. I was likewise not a little astonished to find no fore-teeth in any of these carcasses of the Rhinoceros, although one of the three beasts seemed to be old; and, in fact, this animal has little room for fore-teeth, as the mouth goes off so sharp at the fore-part, that in that place it is only an inch and a half broad. Besides, it has no occasion for any teeth there, as the lips, like the skin, are of that extreme hardness, that it is able to clip off the tops of plants and shrubs with them, and that with so much the greater ease, as the under jaw goes within the upper; so that this species of Rhinoceros is probably capable of laying hold of its food with its lips and conveying it into the mouth, with the same ease and dexterity as Dr. Parsons observed in the common Rhinoceros on a similar occasion.' The spleen was hardly a foot broad, but full four feet long.

Circulating and Respiratory Organs.—The heart was a foot and a half in length and the breadth was not much less. The right lobe of the lungs had an incision in it (probably made by the Hottentots who exenterated the animal, or by the shot, which passed through the great blood-vessels of the lungs, and mortally wounded the animal), but was in other respects undivided and entire: it was two feet in length. The left lung was subdivided into two lobes, the smaller of which was next to the base of the heart.

Urinary System.—The kidneys were a foot and a half in diameter.

There are, we believe, in the museum of the Royal College of Surgeons many preparations of the soft parts of a *Rhinoceros Indicus* which belonged to Mr. Wombwell, and died at Canterbury in the beginning of the year 1838. We had been in hopes that this dissection, which was made by Professor Owen, would have been given to the scientific world as a pendant to the admirable 'Memoir on the Pearly Nautilus,' and in a similar shape.

Integuments and Horns.—The hide of the rhinoceros is perhaps as thick as, if not thicker than, that of any other pachydermatous animal. The horns, solid as they are apparently, consist actually of congregated parallel horny fibres. Fine examples of these horns, and of their gradual increase, will be found in the Museum of the College of Surgeons.

ASIATIC RHINOCEROSES.

Rhinoceros Indicus (*Rhinoceros Unicornis*, Linn.).

Specific Character and Description.—Dental Formula: see above. A single horn on the nose. Skin naked, very thick, of a dull deep purplish grey, marked with subelevated, rounded, and other inequalities, and remarkable for the deep folds which it forms behind and across the shoulders, and before and across the thighs, &c. There are a few stout, stiff, horny, and smooth hairs on the tail and on the ears.

We have seen that a one-horned rhinoceros, this species probably, was shown at Rome by Pompey; that it was well known in the time of Domitian appears from the following epigram (Martial, 'De Spectaculis Libellus,' *Ep.* ix.)·*

> 'Præstitit exhibitus tota tibi, Cæsar, arena,
> Quæ non promisit prælia rhinoceros,
> O quam terribiles exarsit pronus in iras!
> Quantus erat cornu, cui pila taurus erat.'

The best early figure of *Rhinoceros Indicus* known to us is that of Bontius, which, though somewhat exaggerated by the draughtsman about the lip, and furnished with little claws instead of broad nails, gives in general a correct idea of the animal. Bontius states that he has seen the animal a thousand times, both in confinement and in its native wilds, and he states that he gives the figure to correct the error of those painters who have depicted the animal as 'scutatum et squamis obsitum.' He states the following anecdote of its fury when provoked:—A party on horseback had proceeded to a wood, when in a marshy place they came upon a rhinoceros and her young one. The mother, on seeing them, arose and drove her young one towards the wood, and when it stopped as if in sport, pushed it forward with her snout. One of the company, out of a bravado, rode up, and drawing his Japanese sword, cut at the hinder parts of the old one, but the blows did not penetrate, on account of the hide, and some whitish marks only appeared. The mother bore all patiently till her young one was safely hidden in the bushes and brushwood. Then the scene was changed. The irritated beast turned suddenly on her persecutor, whose life was saved by his frightened horse, which galloped back to the party followed by the infuriated rhinoceros overturning trees and everything in her way.

As soon as she saw the rest of the company, she attacked them, and they avoided her by getting behind two great trees, scarcely two feet apart, between which the rhinoceros in the blindness of her rage rushed, making them tremble like reeds. Whilst she was thus entangled, they used their fire-arms with fatal effect, and slew her. The rash man who attacked her by himself had a very narrow escape; for she turned short upon him with a horrible roar 'cum immani grunnitu et stridore,' and seized him by the boot, which fortunately for him was made of light stuff, and gave way. Had it not been for its tearing, 'actum de eo fuisset,' as Bontius says, in plain English it would have been all over with him. The same author, though so anxious to dissipate error, states, in a previous part of this chapter, *De Abada sive Rhinocerote*, that when the animal has prostrated a man, it kills him by licking him with his rough tongue, and tears off both skin and flesh, even to the bones; 'hinc etiam,' he adds, 'spinis ac vepribus libentissimè vescitur,' and he quotes the lines,—

> 'Lingua virum occidit lambendo rhinocerotis,
> Aulica falsidici sic quoque lingua necat.'

It is to this most probably that Sparrman alludes above.

Pennant, who is decidedly of opinion that this species is the Unicorn of holy writ, and the Indian ass of Aristotle (p. 463), says that it loves shady forests, the neighbourhood of rivers, and marshy places; that it brings forth one young at a time, and is very solicitous about it; that it is quiet and inoffensive, but when provoked, furious, very swift, and very dangerous. 'I know a gentleman,' he continues, 'who had his belly ripped up by one, but survived the wound.' Pennant gives the name of this person.†

The rhinoceros described by Dr. Parsons came to London in 1739 from Bengal. It is stated that though but two years old, the expenses of his food and his voyage amounted to near 1000*l.* sterling. He had daily seven pounds of rice mixed with three pounds of sugar: this was divided into three portions. Hay and green herbs were also given to him, but he preferred the latter. He drank largely of water, taking a great quantity at a time, was peaceable when not hungry or provoked, and allowed himself to be handled. When however he wanted to eat, or was irritated by any person, he became unruly, and in both cases he was only to be appeased by food. When he was enraged, he sprang forward, reared himself up, and pushed violently with his head against the walls. Dr. Parsons observed these movements produced by rage or impatience, especially in the morning before his rice and sugar were brought to him. The vivacity and promptitude of these actions led the doctor to think that the animal was altogether unconquerable, and that he could easily overtake any man who should offend him. Dr. Parsons also observed that this rhinoceros hearkened with a sort of continual attention to any noise; so that even if he was drowsy, employed in eating, or in satisfying other urgent wants, he started instantly, and gave attention till the noise had ceased. The *Rhinoceros Indicus* now in the Zoological Society's garden at the Regent's Park has been observed to listen with attention; and, when out, to be thrown into great excitement by the noise of the roller upon the contiguous gravel walk, charging down towards it, and rearing himself up against the fence with great violence.

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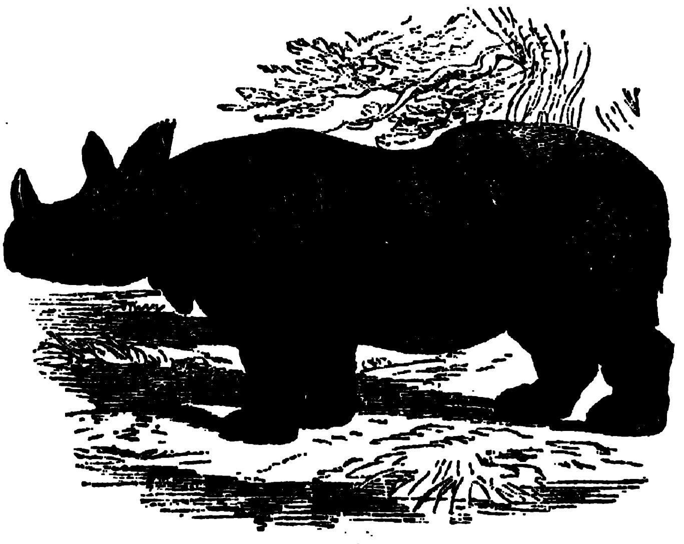
* See also lib. i., *Ep.* 4, xiv., p. 52, 53, &c.

† Charles Pigot, Esq., of Peploe, Shropshire, at that time in the India service.

The rhinoceros brought to this country in 1790 is the subject of an interesting account by Mr. Bingley, in his 'Animal Biography.' When it arrived it was about five years old, was tolerably tractable, would walk about at its keeper's command, and allowed the visitors to pat his back and sides. He was allowed twenty-eight pounds of clover, about the same quantity of ship-biscuit, and a great quantity of greens daily. Twice or thrice a-day five pails of water were given to him. The vessel out of which he drank contained about three pails, and each time as the animal drank the vessel was filled up. He never ceased his draught till the vessel was exhausted. He was fond of sweet wines, and it is stated that he would drink three or four bottles in a few hours. If he saw any person with fruit or any favourite food, he appeared anxious for it, and then uttered a sound something like the bleating of a calf. This animal died of inflammation arising from slipping the joint of one of his fore-legs. It is recorded that the incisions made through his skin, on the first attempts to relieve him, were invariably found to be healed in twenty-four hours. His death happened near Portsmouth, and the stench was so great that the mayor ordered the body to be immediately buried, which was done on Southsea Common. There it lay for about a fortnight, when it was dug up again to preserve the skin and the most valuable of the bones; but the persons employed were nearly overpowered by the effluvia.



Rhinoceros Indicus.

Rhinoceros Indicus,

The renowned combats between the Elephant and Rhinoceros handed down to us from the antients are generally considered to be tinged with fable, but there is no doubt that contentions do occur between them in a state of nature. Soon after the arrival of the Rhinoceros now in the Regent's Park, he contrived to get into the apartment of the old Elephant, but there was no proof of any actual hostility. At present they are the best friends in the world, and it is amusing to see how quiet the Rhinoceros will stand whilst his great friend scrubs his back with his trunk, and occasionally gratifies himself by a sly pull at his tail to make the Rhinoceros turn his head, if his attention is taken off by visitors.

Locality, Food, &c.—This species inhabits the East Indies, especially beyond the Ganges. It is recorded as having been found in Bengal, Siam, and Cochin-China. Shady forests, the neighbourhood of rivers, and marshy places are favourite localities. Their ordinary food consists of herbage and the branches of trees. The flesh is said to be not unpalatable. Our figure is taken from the living animal in the garden of the Zoological Society, but the horn is taken from a perfect specimen; for the animal, though a fine one, and in excellent general health, has ever since its arrival, and from the first growth of the horn, constantly employed itself in rubbing it down, so as to prevent its proper increase.

Rhinoceros Javanus, Cuv.

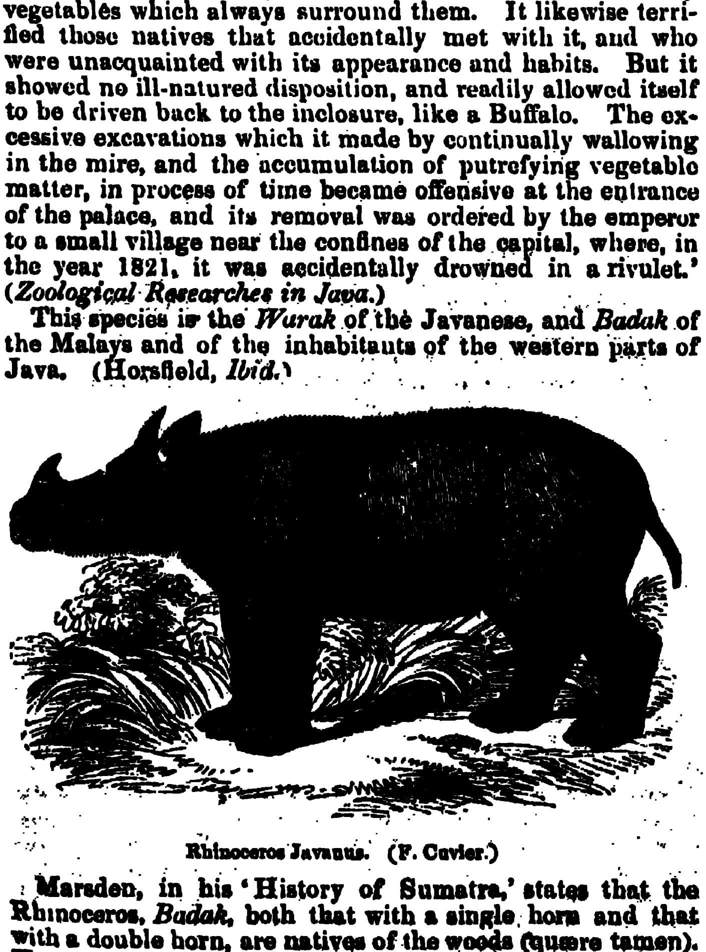
Specific Character.—One-horned; folds of the neck obsolete; scutules of the skin angled at the margin, concave in the middle, and furnished with a few short bristles margin of the ears and under side of the tail hairy.

Description.—Dr. Horsfield, who had an opportunity during his residence at Surakarta, the capital of the Javanese empire, to examine an individual taken during infancy and kept in confinement, or rather in a state of domestication, gives a good figure of it, observing that the drawing from which the plate is taken, though deficient in some points that the skilful pencil of Mr. Daniell would have supplied from the living animal, exhibits, with scrupulous accuracy, its form and proportions. In 1817 this individual measured nine feet in length, and was four feet three inches high at the rump; and Dr. Horsfield remarks, that the Rhinoceros figured by M. F. Cuvier (of which a reduced copy is given below), brought to Europe from the British possessions in India, was higher in proportion to its length, and its form was more unwieldy, the entire length being seven feet, and the height four feet ten inches. The head of the animal seen by Dr. Horsfield was strongly attenuated to the muzzle, and had a triangular form; the flexible lip was considerably lengthened, and the sides of the head were marked with protuberances or scutula, resembling those on the body, but no great roughnesses or folds were apparent. The marks of distinction afforded by the folds of the external covering were less evident than those afforded by the form of the body and the attenuated head; but the folds on the whole appeared less rough or prominent than in *Rhinoceros Indicus;* those of the neck were comparatively smaller; and the posterior fold, which had an oblique direction towards the spine, was less extended. The thick covering of Dr. Horsfield's animal was divided on the surface into small tubercles or polygonous scutula; and a few short bristly hairs rose from a slight depression in the centre. The ears were bordered with a series of long stiff bristles, closely arranged; and a similar series of bristles also extended along the tail, underneath, through its whole length.

Locality, Habits, Manners, &c.—Gregarious in many parts. Dr. Horsfield states that it is not limited to a particular region or climate, but that its range extends from the level of the ocean to the summit of the mountains of considerable elevation. Dr. Horsfield noticed it at Tangung, near the confines of the Southern Ocean, in the districts of the native princes, and on the summit of the high peaks of the Priangan regencies, but it prefers high situations. 'It is not,' adds Dr. Horsfield, 'generally distributed, but is tolerably numerous in circumscribed spots distant from the dwellings of man and covered with a profuse vegetation. On the whole it is more abundant in the western than in the eastern districts of the island. Its retreats are discovered by deeply excavated passages which it forms along the declivities of mountains and hills. I found these occasionally of great depth and extent. In its manners the Rhinoceros of Java is comparatively mild, It is not unfrequently met in the wilds by Europeans and by natives. No instance of its showing a disposition to make an attack has come to my knowledge. Being the largest animal in Java, its passions are not roused, as in many parts of India, by contentions with the elephant. It is rarely seen in a domestic state, but is occasionally decoyed into pits and destroyed. Our animal rambles chiefly at night, and often occasions serious injury to the plantations of coffee and pepper, which are laid out in the fertile districts selected for its retreats. The horns and skin are employed for medicinal purposes by the natives.'

The domesticated individual above alluded to by Dr. Horsfield was taken while very young, in the forests of the province of Keddu, and was conveyed to the residency at Magellan, in the year 1815 or 1816. By kind treatment it soon became domesticated to such a degree, that it permitted itself to be carried, in a large vehicle resembling a cart, to the capital of Surakarta. 'I saw it,' says the Doctor, 'during its conveyance, and found it perfectly mild and tractable. At Surakarta it was confined in the large area or square which bounds the entrance to the royal residence. A deep ditch, about three feet wide, limited its range, and for several years it never attempted to pass it. It was perfectly reconciled to its confinement, and never exhibited any symptoms of uneasiness or rage, although, on its first arrival, harassed in various ways by a large proportion of the inhabitants of a populous capital, whose curiosity induced them to inspect the stranger of the forest. Branches of trees, shrubs, and various twining plants were abundantly provided for its food; of these the species of *Cissus* and the small twigs of a native fig-tree were preferred. But plantains were the most favourite food, and the abundant manner in which it was supplied with these by the numerous visitors tended greatly to make the animal mild and sociable. It allowed itself to be examined and handled freely, and the more daring of the visitors sometimes mounted on its back. It required copious supplies of water, and, when not taking food, or intentionally roused by the natives, it generally placed itself in the large excavations which its movements soon caused in the soft earth that covered the allotted space. Having considerably increased in size, the ditch of three feet in breadth was insufficient for confining it, but, leaving the inclosure, it frequently passed to the dwellings of the natives, destroying the plantations of fruit-trees and culinary vegetables which always surround them. It likewise terrified those natives that accidentally met with it, and who were unacquainted with its appearance and habits. But it showed no ill-natured disposition, and readily allowed itself to be driven back to the inclosure, like a Buffalo. The excessive excavations which it made by continually wallowing in the mire, and the accumulation of putrefying vegetable matter, in process of time became offensive at the entrance of the palace, and its removal was ordered by the emperor to a small village near the confines of the capital, where, in the year 1821, it was accidentally drowned in a rivulet.' (*Zoological Researches in Java.*)

This species is the *Warak* of the Javanese, and *Badak* of the Malays and of the inhabitants of the western parts of Java. (Horsfield, *Ibid.*)



Rhinoceros Javanus. (F. Cuvier.)

Marsden, in his 'History of Sumatra,' states that the Rhinoceros, *Badak*, both that with a single horn and that with a double horn, are natives of the woods (quære tamen). He adds that he does 'not know anything to warrant the stories told of the mutual antipathy and the desperate encounters of these two enormous beasts.' The horn, he adds, is esteemed an antidote against poison, and on that account formed into drinking-cups.

The animal from which the figure was taken was a female. The horn had been worn down by use, and the deficiency is supplied, in the cut, from Dr. Horsfield's figure. M. F. Cuvier says that the upper incisors are four in the young, two in each intermaxillary, very much approximated to each other: they are then small and nearly cylindrical; they soon fall, and are not replaced in adults except by two teeth, 'longues d'arrière en avant, minces de dehors en dedans, sortant à peine des gencives, dont le tranchant est mousse et arrondi, et qui sont opposées à la partie antérieure des longues incisives inférieures.'

Rhinoceros Sumatrensis, Cuv. (*Rhinoceros Sumatranus*, Raffles).

Specific Character.—Four great incisors, as in the two preceding species, but hardly any folds on the skin, which is hairy; a second horn behind the ordinary one.

The first satisfactory indication of the existence of this species occurs in Pennant, who imagined that the two-horned species of Sumatra was identical with *Rhinoceros bicornis*, the only African species then known. He quotes the following remark of Mr. Charles Miller, who was long resident in Sumatra:—'I never saw but two of the two-horned Rhinoceros; but I believe they are not uncommon in the island, but are very shy, which is the reason they are but seldom seen. I was once within twenty yards of one. It had not any appearance of folds or plaits on the skin; and had a similar horn resembling the greater, and, like that, a little turned inward. The figure given by Dr. Sparrman is a faithful resemblance of that I saw.'

Description.—Hide rugose, covered with scattered stiff brown hairs; folds on the shoulders and croup but slightly marked; the skin generally rather delicate and nearly without folds; head rather elongated: eyes small and brown; upper lip pointed and curved downwards; ears small and pointed, fringed with black short hairs; first horn bent backwards, second smooth and pyramidal, placed a little in front of the eyes.

The first figure was published by Mr. William Bell in 1793.

Locality, Sumatra.

Rhinoceros Sumatrensis. (F. Cuvier.)

African Rhinoceroses.

Till a comparatively late period the *Rhinoceros bicornis* of Linnæus (*Rhin. Africanus*, Cuv.) was the only African species distinctly known. The opportunities enjoyed by Dr. Andrew Smith, and of which he has availed himself so much to the advancement of zoology, enabled him to add a third, *Rhinoceros Keitloa*, to the species first recorded and that described by Mr. Burchell.

We have seen that in the Sumatran two-horned Rhinoceros the folds of the skin are hardly perceptible; in the African Rhinoceros there are none on the body; so that the presence of two horns in this genus seems to be a condition of the form coincident with a smooth hide comparatively without folds. Taking into consideration the differences of the dentition, which are striking as far as the incisors are concerned, the two horns and the smoothness of the hide; we think that this genus might be conveniently divided into two groups or subgenera: 1, the one-horned; and 2, the two-horned.

Rhinoceros Africanus, Cuv. (*Rhinoceros bicornis*, Linn.).

Specific Character.—Pale yellow brown; horns unequal in length; neck surrounded with a furrow at the setting on of the head; eyes brown. Length 10 feet 11 inches. (Smith.)

Description.—Pale yellowish-brown, with tints of purple upon the sides of the head and muzzle; the groins flesh-coloured; eyes dark brown; the horns livid-brown clouded with green; the hairs on the tip of the tail and the margins of the ears deep black.

Head rather deep in proportion to its length, which gives it an appearance of clumsiness beyond either of the other South-African species; the anterior horn directly over the extremity of the nose, the first half nearly perpendicular, the last half slightly curved backwards; the posterior horn conical, and often exhibiting an appearance as if the point of a smaller sized cone had been fixed upon the section of a larger one, which observation to a certain extent might also be applied to the front horn; towards the bases both are rough, and more or less distinctly fibrous; towards the points hard, smooth, and finely polished. Eyes small, the skin surrounding them, as well as that in front of the ears and on the muzzle and the upper and lower lips, deeply cut by narrow wrinkles; the extremity of the upper lip is scarcely produced. The neck is thick, short, and at its junction with the head encircled by a deep furrow formed in the skin; the shoulder with a rudimentary hunch; the body round and heavy, limbs rather shorter in proportion than in *Rhin. Keitloa*. Tail flattened towards the extremity, elsewhere somewhat cylindrical: the upper and lower edges near the tip fringed with thick wiry hair. The surface of the skin rather rougher than in *Rhin. Keitloa*, owing to its being intersected by a great number of wrinkles. The relative lengths of the horns vary a little in different individuals, but the hindermost one in both sexes is invariably much the shortest, and in young specimens it is scarcely visible when the other is several inches in length. In *Rhin. Keitloa* the young have both horns of equal length. (Smith.)

Locality, Habits, Food, Chace, &c.—Sparrman, in his description, exposes the errors of Buffon regarding both this species and *Rhin. Indicus*; especially the opinion that the copulation of the latter takes place *croupe à croupe*. His poetical fancies too touching the impenetrable nature of the skin are freely and justly dealt with by the same learned Swede, who ordered one of his Hottentots to make a trial of this with his hassagai on one of those which had been shot. Though this weapon was far from being in good order, and had no other sharpness than that it had received from the forge, the Hottentot, at the distance of five or six paces, not only pierced with it the thick hide of the animal, but buried it half a foot deep in its body.

Dr. Smith remarks that the present species, under the name of *Rhinoster*, has been familiarly known to the colonists of the Cape of Good Hope ever since 1652. In that year, when the Dutch first formed their settlement on the shores of Table Bay, this animal, he observes, was a regular inhabitant of the thickets which clothed the lower slopes of Table Mountain. 'The abandonment of those spots by this animal as a measure of safety,' says Dr. Smith in continuation, 'probably constituted the commencement of a forced migration, which has continued to extend ever since, and which has led not only to the disappearance of the species from the districts within the present colonial limits, but also in a great measure to its removal from countries beyond those limits, as far as hunters sufficiently armed are accustomed to resort. If a system such as has hitherto prevailed continues to exist, and the larger animals persevere in flying to avoid the effects of fire-arms, the time may arrive when the various species which formerly may have been scattered, each in a peculiar locality of a large continent, will be huddled together; and indeed an advance towards that period is in progress, as may be inferred from the concentration which is at present taking place in the interior of South Africa.

'Though many of the individuals which inhabited the countries where now not a single Rhinoceros is to be seen, were doubtless destroyed, yet it is equally certain that many others escaped, and thereby assisted in adding to the accumulation which is in progress in other localities. Until lately the present was the only species of the genus which was known to be receding from its native country, but of late another has been led to a like course; and the *Rhinoceros simus*, which but a few years ago was common in the neighbourhood of Latakoo, has, since the more general introduction of fire-arms into that country, almost entirely ceased to approach within a hundred miles of it. From a consideration of the various facts which we have collected in relation to the species now under consideration, and which we shall detail more at length elsewhere, we feel disposed to regard it to a certain extent as a prisoner in the country it now inhabits, and are inclined to believe the southern extremity of the continent and the country along the western coast towards Benguela to have once formed its favourite residence.'

Sparrman's account of the contents of the stomach of the individual which he dissected indicates the food on which the animal had lived. Dr. Smith states that, like the *Keitloa*, this species feeds upon brushwood and the smaller branches of dwarf trees, from which circumstance it is invariably found frequenting wooded districts, and in those situations its course may often be traced by the mutilations of the bushes. 'As it feeds but slowly,' says Dr. Smith, 'and besides passes much of its time in idleness, it must be regarded as a very moderate eater, and considering that it appears to be fastidious in the choice of its food, it is fortunate for its comfort that it does not require more nourishment. Of the many shrubs which exist in the locality in which it resides, few comparatively appear formed for its choice, as it is to be seen approaching many and leaving them again without either injuring a branch or plucking a leaf. This evident nicety in the selection of its aliment makes it difficult to imagine how so many large animals as are sometimes congregated together within a very limited space can find sufficient for their consumption. Even admitting that the reproduction of the parts which the rhinoceros may devour takes place with uncommon rapidity in the climates they inhabit, and consequently the shrubs are comparatively soon in a condition to supply another meal; yet, nevertheless, if these animals consumed in proportion to their bulk, they would of necessity be forced to be less particular in the choice of their food.'

Sparrman tells us that the Hottentot or Caffre hunters were accustomed to steal both upon the elephant and the rhinoceros while they were asleep, and wound them in different places at the same time. After this they followed the traces of the animal for one or more days, till it dropped down with weakness, or died of its wounds. Generally however, according to their own account, they poisoned one or two of their darts immediately before they attacked an animal of this size; in which case they had no occasion to wait so many days as they otherwise would, before their prey fell into their hands. A farmer told Sparrman that he had seen an elephant in this manner wounded and dead within twenty-four hours.

Rhinoceros Bicornis, Female and Young. (Smith.)

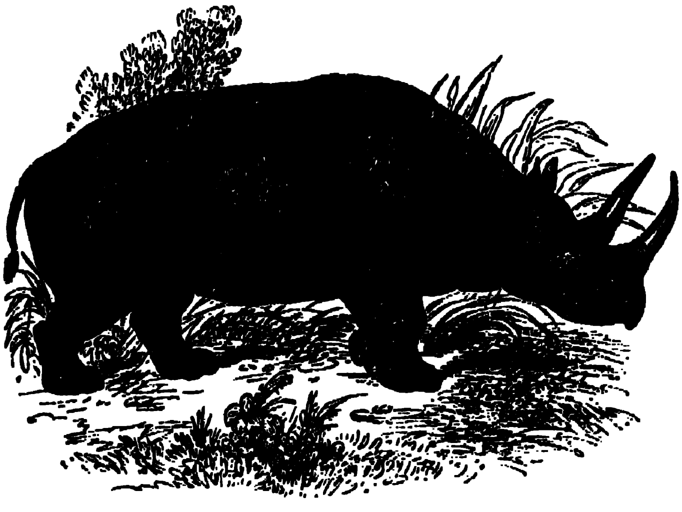
Rhinoceros Keitloa (Smith).

Specific Character.—Pale brownish yellow; the two horns subequal in length, the anterior one cylindrical, the posterior one compressed; anterior part of the upper lip produced and acuminate. Length, body and head, 11 feet and 1½ inches. Height, 5 feet.

Description.—Pale brownish yellow, the brown most distinct upon the head; the inner sides of the extremities towards the body and the groins somewhat flesh-coloured; the inner sides of the knee joint, and the hinder part of the thighs immediately above the joints pale livid black. Eyes dark brown. Horns dark greenish brown.

Figure nearly that of *Rhinoceros bicornis*. Skin destitute of hair, rough and slightly irregular, the surface exhibiting a reticulated appearance, arising from the number of waved or angular fissures by which it is everywhere impressed, but more particularly upon the shoulders and outer surfaces of the hinder extremities. The lower portion of the neck is marked by several wide vertical furrows which admit of the head being turned to either side with greater facility; several of a much smaller size also occur towards the extremity of the muzzle and around the eyes, so as to admit of the upper lip and the eyelids being moved with greater freedom. Head moderately slender; the eyes very small, and sunk in their orbits; the nostrils situated near to the extremity of the muzzle, somewhat oval and rather opaque in relation to the axis of the head. Anterior horn nearly cylindrical, the basal half directed forwards, the distal half slightly curved backwards; the posterior horn towards its base nearly cylindrical, with the distal two-thirds naturally compressed, and having the hindermost edge thinnest. Ears somewhat acuminated, edged with short hairs towards their tips. Legs rather short, knee-joints very large; scarcely any hunch on the shoulders; the neck rather long. Tail cylindrical till within a few inches of the extremity, then naturally compressed and margined above and below by strong short and wiry hair. (Smith.)

Dr. Smith remarks that the only species yet known with which the present could be confounded is the *Rhinoceros bicornis* of authors. There are however, he observes, many and marked differences between them, of which the following are a few of the external and more palpable ones. In *Rhinoceros Keitloa* the two horns are of equal or nearly equal length; in *Rhinoceros Africanus* the posterior in neither sex is ever much beyond a third of the length of the anterior horn; the length of the head in proportion to the depth is very different in the two. The neck of *Rhinoceros Keitloa* is much longer than that of the other, and the position and character of the cuticular furrows destined to facilitate the lateral motions of the head are very different. Besides these, Dr. Smith states that many other diagnostic characters might be instanced; such as the black mark on the inside of the thigh of the *Keitloa*, the distinctly produced tip of the upper lip; and the comparatively few wrinkles on the snout and parts around the eyes.



Rhinoceros Keitloa, Male. (Smith.)

Locality, Habits, &c.—Dr. Smith thinks that it may with propriety be inferred that the *Keitloa* has not, for many years at least, been in the habit of generally extending its range higher than about 25° S. lat. He remarks that we have sufficient evidence that individuals of this species have approached Latakoo, or rather the country some sixty miles to the north of it, in the fact that Mr. Burchell, 'whose merits as a traveller can be best appreciated by those who follow him in the same field, is at present in possession of the horns of an individual which was killed by his hunters.' Dr. Smith further states that the natives at and around Latakoo are only acquainted with two species, viz. *Borili* (*Rhinoceros bicornis* of authors) and *Mohoohoo* (*Rhinoceros simus*, Burch.); and those who were in the employ of the expedition declared, when they first saw the *Keitloa*, that it was not an animal of their country; and at once enlarged upon the points in which it differed from *Borili*. During the discussion an intelligent Moharotsi, who was well acquainted with the animal, approached, called it by its name, and referred Dr. Smith to districts where specimens were found in abundance. As he stated it happened, though everywhere the species appeared rare when compared with the others; and after several months' wanderings it was remarked that only sixty-eight individuals had been seen, eight of which, in one herd (two of them not more than half grown), were disturbed, when feeding near to the banks of a river which the party were descending, by Dr. Smith himself. According to the evidence of the natives given to Dr. Smith, the *Keitloa* is of a very savage disposition, on which account it is more feared than *Borili*, which is also deemed ferocious.

The food of this species consists of small shrubs, or the more delicate branches of brushwood, in collecting which, Dr. Smith observes, the prolongation of the anterior extremity of the upper lip proves a useful assistant.

Rhinoceros simus, Burch.

Specific Character.—Pale grey brown, tinged with yellow brown; margins of the ears towards the tips, and tail both above and below at the extremity clothed with stiff black hairs; mouth ox-like; two horns, the anterior one much the longest; eyes yellowish brown. Length, body and head, 12 feet one inch. Height, at the shoulder, 5 feet 7 inches.

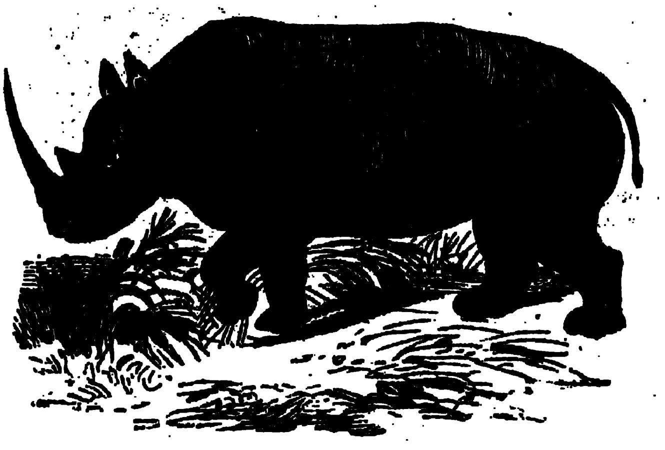
Description.—Pale broccoli-brown, shoulders, buttocks, and belly shaded with brownish purple; hair edging the ears and tip of the tail inferiorly and superiorly black; eyes yellowish brown; horns and hoofs intermediate between broccoli and wood brown; the hoofs darkest.

Figure massive. Head longer, but more delicate in proportion, than in the other African species; face concave; forehead prominent and gibbous. Ears rather long, ovate and pointed, their edges towards the tips margined with rigid hair. Neck longer in proportion than in the other African species, with three well-marked wrinkles on the nape, two of which continue visible almost to the throat. Shoulders elevated into a convex massive hunch; line of the back slightly undulated. Legs stout, and the joints strongly developed and clumsy. Tail vertically compressed at the point, and above and below fringed with short wiry bristles. Horns situated close to the anterior extremity of the head, the foremost directly over the point of the nose, and the second immediately behind it; the first very long, tapered to a point, and slightly curved, the concavity backwards; the second is short, conical, and obtuse at the point. Nose truncated, and mouth shaped like that of an ox, the upper lip perfectly square, and without the least indication of a rudimentary proboscis. Nostrils rather small, opening laterally.

Female, coloured like the male: horns, though less powerful, generally longer than his, except the anterior one. (Smith.)

'Mohoohoo, the name of this species among the Bechuanas,' says Dr. Smith, 'is considered by them to be one of the original animals of their country, and to have issued from the same cave out of which their own forefathers proceeded: in this respect they make a difference between it and *Keitloa*, with whose origin they do not profess to be acquainted. Too much attention cannot be paid to the traditions of savages: what in them often appears calculated only to excite ridicule, may, properly considered, be often made to furnish the most valuable information. Thus, for instance, by attending to what has been termed a useless tradition, we get to know, not merely that the Bechuanas believe the founders of their own nation and the animals of their country originally escaped from a large cave, but also facts of interest touching the geographical distribution of animals, inasmuch as we may rest satisfied, after being aware of the prevalence of the tradition referred to, that all the animals we find in their country, to whose progenitors the afore-mentioned birth-place is not assigned, have immigrated thither since the tradition became current. Every portion however of such traditions must not be literally received, else we shall find travellers who may hereafter visit South Africa propagating errors not less detrimental to the progress of true science than those which were circulated by Kolben, one of the first Cape historians, whose indiscreet credulity led him to relate most extraordinary fictions, *inter alias* one relative to the powers the Rhinoceros exercised over his horns, powers which, had he ever examined into the manner in which these bodies were connected with the parts around and below them, would have been too clearly imaginary to have warranted even the greatest lover of the marvellous in believing him.'

Locality, Food, Habits.—Mr. Burchell, who added so much to our knowledge of the zoology of Africa, found, when he was in Latakoo, this species common there; and the natives told Dr. Smith that it was not unfrequently found even farther to the southward. The last-named author however tells us that it has almost ceased to exist, even in the situations where its discoverer met it; and the Doctor observes that this is accounted for by the danger to which it is exposed being now much increased from the general introduction of fire-arms among the Bechuanas. He also remarks that the form of the mouth at once suggests the kind of food upon which the animal probably subsists; and an examination of the contents of the stomach, principally grass, confirmed the inference. 'Localities abounding in grass are therefore the haunts of the Mohoohoo, and to enjoy them throughout the year, he is necessitated to lead a more wandering life than the two species already figured.'



Rhinoceros simus. (Smith.)

We have here collected, we believe, all the species of this interesting genus actually known. But the same author from whom we have so largely quoted, and to whom those interested in African zoology are so largely indebted, indicates others.

'While in the neighbourhood of the tropic,' writes Dr. Smith, 'we heard of two other species of the genus, which exist still farther to the northward; but, unfortunately, could not obtain any very circumstantial evidence concerning them, as the persons who had seen them were only on a visit in the country they inhabit. One of them was stated to approximate to the *Keitloa;* the other was described as very different to any species previously seen by them, and to have only one long horn towards the forehead. Now, though descriptions of objects by such persons are often inaccurate, from the circumstance of their not having been favourably situated for making correct observations, as well as from a deficiency of language calculated to convey the information they actually possess, I have always remarked that even a hasty examination seemed to supply the savage with more accurate notions of the general characters of animals than it did the civilised man, and therefore I do not despair of species such as they mentioned being yet discovered. It is in regard to the species with the single horn that we experience the greatest hesitation in receiving their evidence as credible; and therefore it is agreeable to have it corroborated by the testimony of a man from a very different part of the country, as obtained and published by a missionary of great research who resided a long time in Madagascar.' Dr. Smith then quotes the following passage, previously observing that the individual who furnished Mr. Freeman with the account of the Ndzoo-dzoo was a native of the country northward of the Mozambique; and that if we admit certain portions of the descriptions to be tainted with errors, we can recognise in the remainder the genuine habits of a Rhinoceros, and probably one of the species with which Dr. Smith's informants were slightly acquainted.

'It appears,' observes Mr. Freeman, 'that the Ndzoo-dzoo is by *no means rare* in Makooa. It is about the *size of a horse*, extremely *fleet* and *strong*. It has *one single horn* projecting from its forehead, from twenty-four to thirty inches in length. This is flexible when the animal is asleep; it can be curled like the trunk of the elephant, but becomes perfectly firm and hard when the animal is excited, and especially when pursuing an enemy. Its disposition is extremely *fierce*, and it universally *attacks* man if it sees him. The usual method of escape adopted by the natives is to climb up a dense and high tree, so as to avoid, if possible, being seen. If the animal misses his sight of the fugitive, he immediately gallops off to his haunt, from whence it may be inferred that he is not endowed with the power of a keen scent. Should he however espy his object in the tree, woe to the unfortunate native; he begins to *butt with his horns*, strikes and penetrates the tree, and continues piercing it till it falls, when his victim seldom escapes being gored to death. Unless the tree is of a large girth, he never fails in breaking it down. Having killed his victim, he leaves him without devouring the carcass. The male only is provided with the horn. The female has not anything of the kind.' (*South African Christian Recorder*, vol. i.) This is sufficiently romantic for Sinbad himself; but still, if we strip the description of its fabulous fringes, we see no reason for objecting to Dr. Smith's opinion as to the animal really meant.

With respect to the other Rhinoceros which was said to exhibit a resemblance to the *Keitloa*, Dr. Smith thinks that it may probably be found to belong to a species which has its principal habitat in Northern Africa, a conclusion to which he was led from an examination of a pair of horns in the Museum of the College of Surgeons obtained in Abyssinia by Mr. Salt. These horns differ considerably from those of *Rhinoceros bicornis;* and, in form, approach those of *Rhinoceros Keitloa*. Dr. Smith further observes that another pair of horns, probably of the same species, is preserved, according to Sparrman,[*] in the cabinet of the Royal Academy of Sciences, the foremost of which is twenty-two inches in length, and the hindmost sixteen: the distance between them is barely two inches. Different again from these and from all Rhinoceroses Dr. Smith had seen, are two contained in the British Museum, and obtained by Major Denham during his journey in North Africa; and Dr. Smith is of opinion that if they do not prove to have belonged to young individuals of *Rhinoceros simus*, they must be referred to a species not yet characterised: they are of a lighter colour than any horns which Dr. Smith had had an opportunity of examining, and, along with a peculiarly corneous aspect, they have a considerable degree of semi-transparency. The horns of *Rhinoceros simus* possess more of this character than any others yet known, which circumstance, together with the fact of which Dr. Smith had been informed by Professor Owen, namely, that clubs of Rhinoceros horn about three feet in length had been obtained from Western Africa (kingdom of Dahomy), would, in Dr. Smith's opinion, lead to a supposition that either the species discovered by Burchell, or one with certain of its characters, inhabits North Africa.[†]

'Now,' says Dr. Smith in conclusion, 'though I am not prepared to maintain that the horns of each individual of the same species of Rhinoceros are found to be uniform, as regards size and form, or even that the relative lengths of the first and second horns are constant in different animals, yet from what I have observed in the South African species, I do not think we are justified in believing the horns of the same species to be subject to any great variations in respect to relative length. When the Rhinoceros of Abyssinia shall have been minutely examined, it will probably be found to be distinct from the *Rhinoceros bicornis*, Linn., and be identical with the animal stated, by the natives who communicated with us near the tropic of Capricorn, to be like the *Keitloa*. The other species of which they spoke will possibly be identical with the Ndzoo-dzoo and a nondescript: while the one, from which were obtained the horns referred to as in the British Museum, may prove either a *Rhinoceros simus*, or a third undescribed species.' (*Illustrations of the Zoology of South Africa.*)

There are in the British Museum stuffed specimens of the three African species above recorded: they were purchased at the sale of the African Museum.

In Captain Harris's *Wild Sports of Southern Africa*, the reader will find lively descriptions of the chace and habits of these animals. Their flesh is not unpleasant food. Sparrman had a piece of one of the animals shot by his party broiled immediately: it tasted in a great measure like pork, but, in his opinion, was much coarser.

FOSSIL RHINOCEROSES.

The Fossil Rhinoceroses hitherto discovered may be divided into three groups—1, those with a true or bony sep-

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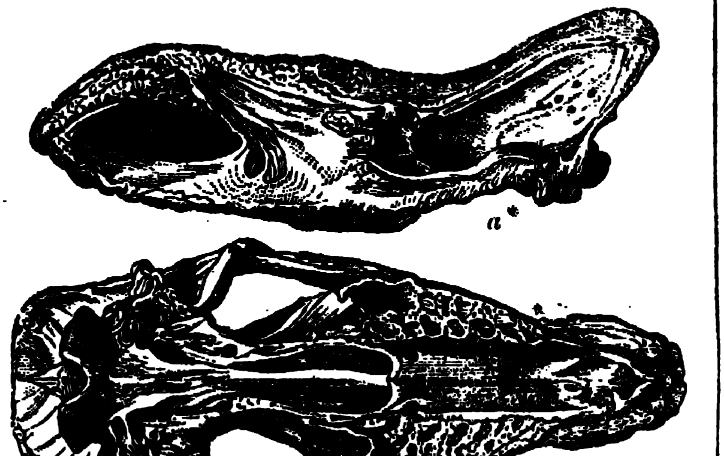
[*] 'Voyage to the Cape of Good Hope,' 4to., vol. ii., p. 100.

[†] A Rhinoceros horn wrought for a walking-staff, and so as to make it appear like the horn of 'a *real* unicorn,' was sent to this country by the king of Dahomy; it was, we believe, gorgeously fitted up and sent back to the king.

tum narium; 2, those without a bony septum; and 3, those with incisor teeth.

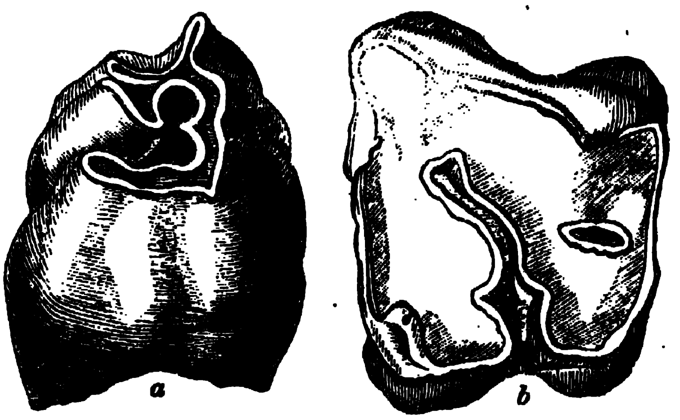
The greater portion of remains found in Northern and Central Europe and Asia belong to the first group; those found in Italy belong to the second.

The skulls of the Rhinoceroses belonging to the first group exhibit an essential difference when compared with those of the living species. Those of the former are longer and narrower in proportion; the width between the orbits is less; the bones of the nose are more elongated; the disk on which the anterior horn was seated is an oblong ellipse, whilst in *Rhinoceros bicornis* it is a demisphere. An analogous elongation exists in the place where the second horn was situated, whence Cuvier concludes that the horns of the Rhinoceros with a bony *septum narium* were very much compressed laterally. The same great zoologist remarks that in *Rhinoceros bicornis* or *Africanus* (Cape Rhinoceros) the occipital crest is nearly over the occipital condyles, and the posterior surface of the occiput is nearly perpendicular to the axis of the head. In *Rhinoceros Javanus* this surface is inclined forwards, which renders the distance from the nose to the crest shorter than that from the nose to the condyle in a proportion of 19 to 25; and it is much the same in *Rhinoceros Sumatrensis.* In *Rhinoceros Indicus* this forward inclination is still more remarkable, although the difference of the two lines is less in the proportion of 21 to 25, on account of the extreme height of this occipital surface. In all the fossil skulls, on the contrary, the occipital surface is strongly inclined backwards, and the distance from the nose to the crest much longer than that from the nose to the condyles. It would seem, says Cuvier in continuation, that in some fossil individuals the two horns did not touch each other; but in one from the neighbourhood of Rugby, which Cuvier saw in the Radcliffe Library at Oxford, and of which Mrs. Buckland made a drawing for his work, he is of opinion that the horns touched, for the disks on which they were seated are confounded together in one rugose surface.



Skull of Fossil Rhinoceros. (Cuv.*) *a*, profile: *b*, seen from below.

But, besides the difference of form of the disks, there is, observes Cuvier, on the middle of the anterior one a longitudinal projecting ridge, whilst in *Rhinoceros bicornis* there is a furrow which becomes very deep forwards. Far, too, from having the anterior apophysis of the superior maxillary bone short, and the intermaxillary bones very small, as in *Rhin. bicornis,* the fossil two-horned rhinoceros with the bony septum has those parts extremely long and strong, longer even than in any of the other rhinoceroses; which renders the length of its nasal notch more considerable; in fact, a fourth of the whole length. In the young *Rhin. bicornis* it only makes a sixth, and in the adult a seventh; in the two-horned Sumatran species and the one-horned Javanese species, it is less than a fourth; and in the *Rhinoceros Indicus* rather less than a fifth. This same fossil, remarks Cuvier in continuation, has at the upper border of the incisive bone a prominence, which neither exists in *Rhinoceros bicornis,* nor in *Rhin. Sumatrensis,* nor in *Rhin. Javanus.* It exists only in *Rhin. Indicus,* which differs so much in all other respects from the fossil. But the most important character of the fossil rhinoceros is the form of the nasal bones and their junction with the incisive bones; and it is in this part distinguished not only from the other rhinoceroses, but from all other known animals. The point of the nasal bones, instead of terminating in the air at a certain distance above the incisive bones, descends without thinning off in front of the nasal notches, and, after being divided into three projecting tubercles, is joined by a rather more delicate portion to the spot where the incisive bones unite, and themselves form two other tubercles. All four of these bones are so well soldered together, that only one suture is perceptible, even at an advanced age. The suture which distinguishes the intermaxillary from the maxillary bone is not visible. This solid construction was, observes Cuvier, no doubt destined for the support of the horn, and affords evidence that this fossil rhinoceros had larger and stronger ones than those of the present day, and a consequently increased power of using them. Behind this junction of nasal bones with the incisive bones commences a bony septum, which separates the two nostrils, and which is directed backwards in order to its junction with the *vomer.* In youth this septum appears to have been only cartilaginous; but as the animal advanced in age it became bony, and at last was soldered to the vomer, thus forming one bony continuation. No living rhinoceros yet discovered has this bony septum, the result of which is that the incisive holes are separated from each other, whilst in the living species they are confounded into one vast opening. The length of the nasal notch seems to have been the cause of the backward position of the eye, which had a more posterior situation in this rhinoceros than in the others. The notch of the posterior nostrils is much wider: it does not terminate in a point forwards, but is there nearly squared. The palate is narrower and more elongated in proportion.



a, Crown of a sixth molar, but little worn, of a fossil Rhinoceros. *b*, Molar of a fossil Rhinoceros, much worn, seen from above.

The skulls of the group of fossil rhinoceroses which have no bony *septum narium* much resemble that of *Rhinoceros bicornis.* As compared with the cranium of the ordinary fossil rhinoceros which has the bony septum, the cerebral part of the skull is less prolonged and less thrown backwards; the orbit is placed above the fifth molar; the nasal bones terminate in a free point, and are not attached to the intermaxillary bones by a vertical septum; the intermaxillaries are much less prolonged and of a different conformation, offering none of the characters which render the other fossil skulls of this genus so remarkable. But though the skulls without the bony septum approach more to that of the *Rhin. bicornis* than of any other living species, there are notwithstanding several differences. The bones of the nose in the last-mentioned fossils are delicate, straight, and pointed; whilst those of *Rhin. bicornis* are very thick and convex; the intermaxillaries of the fossil are much larger than those of *R. bicornis,* and the zygomatic arch is shorter and more convex towards the top; moreover there is a deeper depression between the part which supports the second horn and that which elevates itself to form the occipital crest.

The lower jaws of the fossil rhinoceroses do not offer less differences between each other than those of the skulls of the respective species. Those of Siberia are remarkable for the narrowed prominence of their anterior part in front of the first molars: at the extremity of this prominence Pallas thought that he detected the remains of the alveoli of incisors. In this character these jaws resemble the one-horned rhinoceros, where the part before the molars is only a little wider. On the contrary, the most common of the Tuscan lower jaws have their molars brought very near to their point, which is short and not prolonged into a prominence; in which respect they entirely approach *Rhin. bicornis*. They also approached it in all the parts which Cuvier was able to compare, as in the roundness of the lower parts of the branches, the position and size of the holes, and the obliquity of the coronoid apophysis, more than the one-horned rhinoceroses. Differences which our limits forbid us to point out in detail, and which the student will find well followed in the *Ossemens Fossiles*, exist in the rest of the skeletons of the fossil species as compared with the living ones, and even with each other.

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* From a skull from Siberia, given by Dr Buckland to the Paris Museum. (Cuv.)

The fossil rhinoceroses furnished with incisor teeth were much smaller than any known species, living or fossil.

The following fossil species have been recorded:—*Rhinoceros tichorinus*, Cuv.; *Rhinoceros incisivus*, Cuv.; *Rhinoceros leptorhinus*, Cuv.; *Rhinoceros minutus*, Cuv.; *Rhinoceros elatus*, Croiz. and Job.; *Rhinoceros pachyrhinus*, Cuv.; *Rhinoceros hypselorhinus*, Kaup.; *Rhinoceros Goldfusii*, Kaup.; *Rhinoceros leptodon*, Kaup.[*]

Geological Position.—Remains of this genus occur in the tertiary series of beds (Miocene and Pliocene periods of Lyell; in the strata of the last-named period they are most abundant). They are extensively found in the gravel, the bone caverns, and osseous breccia. In 'Reliquiæ Diluvianæ,' Dr. Buckland states that the facts developed in the cave at Kirkdale demonstrate that there was a long succession of years in which the Elephant, Rhinoceros, and Hippopotamus had been the prey of Hyænas, which, like themselves, inhabited England in the period immediately preceding the formation of the diluvial gravel. 'If they inhabited this country,' says Dr. Buckland, in continuation, 'it follows as a corollary, that they also inhabited all those other regions of the northern hemisphere in which similar bones have been found under precisely the same circumstances, not mineralized, but simply in the state of grave bones imbedded in loam, or clay, or gravel, over great part of northern Europe, as well as North America and Siberia.' The entire Rhinoceros found in the frozen soil at Wiluji, or Vilhoui, in Siberia, recorded by Pallas, was a most striking discovery, and, followed as it was by the detection of an Elephant in a mass of ice on the shores of the North Sea [ELEPHANT, vol. ix., p. 353], aroused the minds of men to a consideration of the causes which might have produced such effects. Dr. Buckland thus comments on the state of the climate in which these extinct species may have lived:—'It is the opinion of Cuvier, on the one hand, that as some of the fossil animals differ from existing species of the genera to which they belong, it is probable that they had a constitution adapted to endure the rigours of a northern winter; and this opinion derives support from the Siberian elephant's carcass, discovered with all its flesh entire, in the ice of Tungusia, and its skin partially covered by long hair and wool; and from the hairy Rhinoceros found in 1771, in the same country, in the frozen gravel of Vilhoui, having its flesh and skin still perfect, and of which the head and feet are now preserved at St. Petersburgh, together with the skeleton of the elephant above alluded to, and a large quantity of its wool; to which Cuvier adds the further fact, that there are genera of existing animals, *e.g.* the fox tribe, which have species adapted to the extreme both of polar and tropical climates. On the other hand it is contended that the abundant occurrence of fossil crocodiles and tortoises, and of vegetables and shells (*e.g.* the *Nautilus*) nearly allied in structure and character to those which are now peculiar to hot climates in the secondary strata, as well as in the diluvium of high northern latitudes, renders it more probable that the climate was warm in which these animals lived and died, than that any change of constitution and habit should have taken place in so many animal and vegetable genera, the existing members of which are rarely found, except in the warmer regions of the present earth. To this argument I would add a still greater objection, arising from the difficulty of maintaining such animals as those we are considering amid the rigours of a polar winter; and this difficulty cannot be solved by supposing them to have migrated periodically, like the Musk-Ox and Rein-Deer of Melville Island; for in the case of Crocodiles and Tortoises extensive emigration is almost impossible, and not less so to such an unwieldy animal as the Hippopotamus when out of the water. It is equally difficult to imagine that they could have passed their winters in lakes and rivers frozen up with ice; and though the Elephant and Rhinoceros, if clothed in wool, may have fed themselves on branches of trees and brushwood during the extreme severities of winter, still I see not how even these were to be obtained in the frozen regions of Siberia, which at present produce little more than moss and lichens, which during great part of the year are buried under impenetrable ice and snow; yet it is in these regions of extreme cold, on the utmost verge of the now habitable world, that the bones of elephants are found occasionally crowded in heaps along the shores of the icy sea, from Archangel to Behring's Straits, forming whole islands composed of bones and mud at the mouth of the Lena, and encased in icebergs, from which they are melted out by the solar heat of their short summer, along the coast of Tungusia, in sufficient numbers to form an important article of commerce.' Dr. Buckland then observes that he is, in the work quoted ('Reliquiæ Diluvianæ') concerned only to establish two important facts;—first, that there has been a recent and general[*] inundation of the globe; and, secondly, that the animals whose remains are found interred in the wreck of that inundation were natives of high north latitudes, and not drifted to their present place from equatorial regions by the waters that caused their destruction. 'One thing however is nearly certain,' adds Dr. Buckland, 'viz. that if any change of climate has taken place, it took place suddenly; for how otherwise could the elephant's carcass found entire in ice at the mouth of the Lena have been preserved from putrefaction till it was frozen up with the waters of the then existing ocean? Nor is it less probable that this change was contemporaneous with and produced by the same cause which brought on the inundation. What this cause was, whether a change in the earth's axis, or the near approach of a comet, or any other cause or combination of causes purely astronomical, is a question the discussion of which is foreign to the object of this memoir.'

The distribution over the earth's surface of the remains of this genus is very wide. Almost every bone-cavern in England, Germany, and France contained them. They occur in the Epplesheim sand, in the bone breccia at Nice, and at Gibraltar. Mr. Crawfurd collected them on the left bank of the Irawadi, 250 miles below Ava; and Captain Cautley found them in great abundance in the Sewalik mountains, at the southern foot of the Himalayas. [ELEPHANT, vol. ix., p. 354.]

RHINOCU'RUS. [FORAMINIFERA, vol. x., p. 348.]

RHINOLOPHI'NA. [CHEIROPTERA, vol. vii., p. 23.]

RHINO'LOPHUS. [CHEIROPTERA, vol. vii., p. 23.]

RHI'NOPHIS, Wagler's name for a genus of Serpents with a pointed conical muzzle, the tip of the tail enveloped in an oval horny shield, and the eyes hidden. Mr. Swainson arranges it as a subgenus of *Typhlops*, in the family *Amphisbænidæ*.

RHINOPI'RUS, Merrem's name for a genus of Serpents, *Erpeton* of Lacépède. [ERPETON.]

RHIO is a Dutch colony, established in 1817, on the island of Bintang, which lies opposite Cape Romania, one of the promontories with which the Malay peninsula terminates on the south. The island of Bintang is a little larger than that of Singapore, and contains about 300 square miles. It is however more fertile, and produces much terra japonica; above 4000 tons are annually exported. Much pepper is also grown. After Java, Malacca, and the other Dutch colonies had been restored to the Dutch, the Dutch government intended to make themselves masters of the commerce of the Indian Archipelago, and with that view took possession of the town of Rhio, where they built a fortress; but the foundation of the town of Singapore and the rapid growth of that British colony has frustrated their design: yet Rhio is a thriving place. It is visited by the Bughis and other Malay vessels from the adjacent islands, and by the Siamese, though they prefer going to Singapore, where their commodities fetch a better price and are more easily saleable. The town and fortress of Rhio are built at the entrance of a wide inlet, called the bay of Tanjong Pinang. The harbour is good and safe, but at its entrance there are many small rocky islands, which render the navi gation difficult and dangerous. Rhio is in 50′ N. lat. and 104° 28′ E. long.

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[*] The *Calodonta* of Bronn is a fossil rhinoceros, in all probability *Rhinoceros tichorinus*.

[*] See the works of Lyell, Phillips, and other geologists, and the article on GEOLOGY in this work, vol. xi., p. 129.

(Crawford's *Journal of an Embassy to the Courts of Siam and Cochin China;* Moor's *Notices on the Indian Archipelago*, Singapore, 1837.)

RHIPIDU'RA. [MUSCICAPIDÆ, vol. xvii., p. 13.]

RHIZANTHS. [RAFFLESIA.]

RHIZOMORPHA, a singular genus of fungi, having altogether the appearance of the root of a tree. The species are found in damp cellars, old walls, mines, and other subterranean places, where they sometimes acquire a phosphorescent state, which renders them exceedingly curious objects. Nothing is at present known of their mode of reproduction or origin; but it is thought that they spring out of decaying wood buried in the ground. The genus Rhizomorpha is not included in Hooker's 'English Flora,' but it is mentioned by Mr. Berkley, who wrote the mycological department of that work, as a fungous production, originating in tan-pits. Several species are mentioned by authors, of which R. medullaris is the most common. This is so like the root of a tree divided into numerous fibres, that it is probably often mistaken for it. Independently however of its cellular organization, so different from that of wood, it may always be known by its musty smell.

RHIZO'PHORA, a genus of plants which gives its name to the natural family of Rhizophoreæ, or the Mangrove tribe, the plants of which are remarkable for their seeds germinating even while attached to the branches, and also for the numerous adventitious root-like projections which serve as supports for the stem. The common Mangrove and also others of the genus are found all along the shores of the tropics, both in the new and old world, rooting in the mud, and forming dense forests even at the verge of the ocean, and below high-water mark; hence, on the retiring of the tide, the stems may often be seen covered with oysters and other shell-fish. The genus may be briefly characterised as having—a four-parted adherent calyx. Petals four, the margins each with a long row of double hairs. Stamens twice as many as the petals. Ovary 2-celled, with 2 ovules in each cell. Style short. Stigma 2-toothed. Fruit oblong, crowned with the persistent segments of the calyx, at length perforated at the apex by the radicle of the germinating embryo. Trees with entire leaves. Inflorescence axillary. The wood of several species is hard and durable, and the bark astringent.

R. Mangle, the common or black Mangrove, is found abundant on the shores of the ocean, and within the delta of the Ganges, where it grows to a considerable size. The seed of this species, which is from one to two feet long, very quickly gives rise to a young tree, and, as mentioned by Browne, in his 'History of Jamaica,' if the apex from whence the root issues be stuck only a little way in the mud, the leaves quickly unfold at the opposite end. The wood is dark-red, hard, and durable, and the bark is used for tanning leather.

R. Candel, Red Mangrove, or *Paletuvier.*—The branches of this species, though they bend downwards, do not take root in the ground. The wood is heavy, of a deep-red, and takes a fine polish. The bark is used in dyeing red, is astringent, and used in the West Indies for the cure of fevers, as well as of the bites of venomous insects.

R. gymnorhiza grows to a considerable size where the spring-tides rise over it, as in the delta of the Ganges. The wood is yellow, hard, and durable; has a sulphurous smell, and burns with a vivid light; is chiefly used by the natives for fire-wood and for making posts for constructing their houses. The pith of the wood, boiled in palm wine or with fish is used as food.

RHIZOPHY'SA. [PHYSOGRADA, vol. xviii., p. 137.]

RHIZO'STOMA. [PULMOGRADA, vol. xix., p. 124.]

RHIZOSTO'MIDÆ. [PULMOGRADA, vol. xix., p. 121.]

RHODE ISLAND (Island). [RHODE ISLAND (State).]

RHODE ISLAND, one of the United States of North America, is bounded on the north and east by Massachusetts, on the west by Connecticut, and on the south by the Atlantic. It extends from 41° 18′ to 42° N. lat. and from 71° 6′ to 71° 58′ W. long., Block Island not included. The largest part of the state lies to the west and north-west of Narraganset Bay, and comprehends about 900 square miles; a small portion lies to the east of Narraganset Bay; and the rest is composed of the islands of Rhode Island, Connecticut Island, Prudence Island, Patience Island, Hope Island, Hog Island, Dyer's Island, and Block Island, all of which are in Narraganset Bay, except the last, which is in the Atlantic. The whole area of the state is estimated at 1350 square miles, which is about the area of the English county of Shropshire. It is the smallest state in the Union, though there are others which have a less number of inhabitants. The population, in 1790, was 69,110; in 1800, 69,122; in 1810, 77,031; in 1820, 83,059; and in 1830, 97,199, which is 72 to a square mile, being in density of population inferior only to Massachusetts, which by the same census has 81 to a square mile. The number of slaves included in the population was 952 in 1790; 831 in 1800; 103 in 1810; 48 in 1820; and 17 in 1830.

The island of Rhode Island, which gives name to the state, is the largest of the islands which belong to it. The central part of it is in 41° 32′ N. lat. and 71° 15′ W. long. Its length is about 15 miles from north to south, with an average breadth of about 3½ miles. This island is the most fertile part of the state; the soil is suitable either for tillage or grazing, and is well cultivated; and the climate is so temperate and wholesome, that the island is a place of resort for the inhabitants of the southern and central states in the summer months, and for invalids at all seasons.

Narraganset Bay, which intersects a large portion of the state, is about 28 miles long from Point Judith, on the south, to Bullock's Point, 5 miles below Providence, on the north. The entrance extends from Point Judith on the west to Seekonnet Rocks on the east. The average breadth of the bay is about 10 miles. It forms a safe road during the north-west storms, is navigable in all seasons, contains several excellent harbours, and has many points suitable for defence, which have been strongly fortified.

The surface of the continental part of Rhode Island is generally level, but is hilly and rocky in some parts, chiefly to the north-west. The principal rivers are the Seekonk, the Pawtucket, the Pawtuxet, and the Pawcatuck, all which have a short course. The soil is generally thin, and for the most part better fitted for pasturage than for the plough. Cattle and sheep are raised in great numbers on the islands and on the coasts of Narraganset Bay. Wheat, oats, barley, and rye, and also many kinds of fruit, are cultivated to a considerable extent, and the rivers and bay supply plenty of fish. There are mines which afford abundance of iron-ore, and small quantities of copper-ore are obtained. Limestone is abundant, and there is a mine of anthracite coal in the northern part of the island of Rhode Island.

The exports of Rhode Island consist principally of cattle, horses, poultry, fish, beef, cheese, butter, lumber, and flax-seed, cotton and linen manufactures, and iron manufactures. The manufactures are in a very flourishing condition, and are rapidly increasing. Providence is the chief point of manufacturing and commercial industry. The imports consist for the most part of the produce of the West Indies and the manufactures of Europe. The exports in the year ending September 30, 1839, were of the value of 185,234 dollars, of which 175,808 were for domestic produce, and 9426 for foreign produce. The imports were of the value of 612,057 dollars, of which 610,431 were in American vessels, and 1626 in foreign vessels. The shipping, on the 30th of September, 1839, was estimated at 44,572 tons.

There is a railroad from Providence to Stonington, the length of which is 47 miles. The total length of canals in Rhode Island is 38 miles.

The General Assembly of Rhode Island meets four times a-year. The senate is composed of a governor, lieutenant-governor, and ten senators. The governor is elected half-yearly, and has a salary of 400 dollars. The lieutenant-governor, also elected half-yearly, has a salary of 200 dollars. The House of Representatives consists of 72 members, elected half-yearly, in April and August.

There is a supreme court, and there is also a court of common pleas for each of the five counties into which the state is divided. The supreme court consists of a chief-justice, with a salary of 650 dollars, and two associate justices, with salaries of 550 dollars each. All the judges are appointed annually by the General Assembly. The district court meets in February and August at Providence, and in May and October at Newport. The circuit court is held at Providence in November, and at Newport in June

Rhode Island has no state debt. In December, 1839 there were 62 banks, with a capital of 9,880,500 dollars specie to the amount of 537,895 dollars, and a circulation of 1,719,230 dollars.

The state pays 10,000 dollars a year for the support of free schools, which is divided among the different towns according to their population. Brown University is the only one in the state, but there are ten or twelve academies, and about 300 elementary schools not supported by the state. In 1834 there were 16 newspapers published in the state – 9 at Providence, 3 weekly at Newport, 1 weekly at Bristol, 1 weekly at Warren, 1 weekly at Pawtucket, and 1 weekly at Woonsocket Falls.

Of the religious denominations, which are said to amount to about 100, the Baptists are the most numerous; then follow the Methodists, Congregationalists, Unitarians, Sabbatarians, Six-Principle Baptists, Quakers, &c.

Rhode Island has two capitals, Providence and Newport.

Providence is a corporate city, and considerably the largest and most flourishing town in the state, in 41° 51′ N. lat. and 71° 26′ W. long. It is situated at the head of Narraganset Bay, at the top of an inlet which is called Providence River, but which is only an arm of the bay reaching to the mouth of the Seekonk river. The town is built on both sides of the Providence River, and the two parts are connected by bridges, the longest of which is 90 feet. Vessels of 900 tons burthen can come up to the wharfs. Most of the houses are of wood, and painted white, but there are several of granite and brick. The inhabitants amount to upwards of 20,000. The chief public buildings are—the State House, of brick; the Arcade, which is a magnificent building of Doric architecture, the body of stone, and the two fronts and the columns of granite; the two halls of Brown University, of brick; the Dexter Asylum, of brick, for the poor of Providence; the Friends' Boarding-school, of brick, with a basement of granite; and some of the churches are handsome buildings. Brown University, originally founded at Warren in 1764, but removed to Providence in 1770, is chiefly under the direction of the Baptists. It has 9 instructors, 1390 alumni, 474 ministers, 177 students, and a library of 14,000 volumes. There are several public schools, and three or four libraries belonging to literary institutions. In 1834 there were 9 newspapers published at Providence, 3 daily, 2 semiweekly, and 4 weekly; 1 literary journal, weekly; and 4 monthly periodicals.

Providence is a place of great manufacturing industry. There are large cotton manufactories, worked both by steam and by water-power; extensive bleaching establishments; dye-houses; iron-foundries; manufactories for making cotton-machinery; steam-engines and steam-boilers; brass-foundries; establishments for working in tin, sheet-iron, copper, brass, &c.; numerous jewellers' and goldsmiths' shops; a large glass-house; besides hat, soap, and several smaller manufactories.

In 1831 the imports into Providence amounted to 457,717 dollars; the exports to 329,634 dollars. The shipping on the 31st of December, 1832, was estimated at 19,136 tons. There were 4 insurance companies and 15 banks, besides a branch of the United States Bank; and also a savings' bank. The Blackstone canal, which extends from Providence to Worcester in Massachusetts, was completed in 1828. It is 45 miles long, and is navigated by about 30 boats of from 25 to 30 tons each. Providence is 190 miles north-east from New York, 40 miles south-south-west from Boston, 30 north from Newport. Passengers from New York are brought by steam-boats to Providence on their way to Boston.

Newport, the town next in importance to Providence, is situated at the south end of the island of Rhode Island, in 41° 29′ N. lat. and 71° 21′ E. long. It has between 8000 and 9000 inhabitants. The situation is very beautiful, and it has a fine harbour.

The other towns of most importance are:—Scituate, with 6850 inhabitants; Warwick, with 5500; Smithfield, with 4000; Coventry, with 3850; New Providence, with 3500; South Kingston, with 3700; North Kingston, with 3000; and Bristol, with 3000. Pawtucket, a large village not far from Providence, and connected with that city by one of the finest roads in the United States, has some considerable cotton manufactures.

The circumstances under which Rhode Island was founded, as connected with the opinions and conduct of its founder, Roger Williams, are sufficiently curious and interesting to merit a short detail.

Roger Williams was a native of Wales, and born in 1598. He was educated at the university of Oxford, and admitted to orders in the church of England, but having embraced the opinions of the Puritans, the severity of the laws against non-conformists occasioned him to embark for North America, where he arrived, with his wife, on the 5th of February, 1631. The principles which Williams began to preach at Boston were those of unlimited religious toleration, extended not merely to every sect of Christians, but to Jews, Mohammedans, heathens, and infidels. This extent of toleration was not approved by the New England churches, and Williams having been chosen by the people of Salem as assistant-teacher, the court of Boston 'marvelled' at their precipitancy, and they were required to 'forbear.' They did forbear, and Williams withdrew to Plymouth, where he was also engaged as assistant-teacher, and remained two years. In 1633 he returned to Salem. He had written an essay in which he contended that the patent of the king of England could not rightfully dispose of the lands of the natives without their consent. For this he was summoned on the 24th of January, 1634, before the court of Massachusetts, when, having explained the purport of the offensive manuscript, and consented that it should be burnt, the court declared that 'the matters were not so evil as at first they seemed.'

The magistrates of Massachusetts required every man to attend public worship. Williams reprobated the law (35 Eliz., c. 1) by which they enforced it, and this was another ground of offence to the magistrates. The English government had become extremely jealous of the proceedings in Massachusetts, and with the view of preparing for resistance, the Freeman's Oath, which required every freeman to swear allegiance not to King Charles but to Massachusetts, was administered by the magistrates. Williams denied the right of a compulsory imposition of an oath; and when summoned before the court, March 30, 1635, he maintained his opinion, and 'the government was *forced* to *desist from* that proceeding.'

Soon afterwards the church of Salem chose him for their teacher, and Williams having asserted that 'the civil magistrate might not intermeddle to stop a church even from apostacy and heresy,' the magistrates blamed the people of Salem for their choice of a teacher, and as a punishment withheld from them a tract of land to which they had a claim. Williams now, in conjunction with his church, wrote 'letters of admonition unto all the churches whereof any of the magistrates were members, that they might admonish the magistrates of their injustice.' This was held to be little less than treason, and the next general court disfranchised Salem till an apology for the letter should be made. The town and the church submitted. In October, 1635, he was summoned before the general court, and required to renounce the offensive opinions; but he maintained 'the rocky strength of his grounds.' The general court then pronounced a sentence of banishment against him, but as the winter was near, he obtained permission to remain till spring. And now the people of Salem could no longer be restrained; they thronged to his house to hear him; and as many were 'much taken with the apprehension of his godliness,' and there was evident danger of the infection of his opinions spreading very widely, it was resolved to send him to England in a ship then ready to sail. A warrant was sent requiring him to come to Boston to embark. He refused to come. A pinnace was sent to bring him, but he had fled. It was the depth of winter (January, 1636). 'For fourteen weeks he was sorely tossed in a bitter season, not knowing what bread or bed did mean.' He wandered towards Narraganset Bay, and was welcomed by the Indians, whose language he had learned. In June, 1636, with five companions, he founded his little settlement at the mouth of the Seekonk river. He named the place 'Providence.' 'I desired,' he said, 'it might be for a shelter for persons distressed for conscience.' On the 24th of March, 1638, the chiefs of the Narragansetts, to whom the territory belonged, presented him with an Indian deed, which made him the entire owner of a large domain; but he reserved none of it for himself; 'he gave away his lands and other estate to them that he thought were most in want, till he gave away all.'

This was the foundation of the state of Rhode Island, which was then called *Providence Plantations*. A sect of violent Antinomian Calvinists had sprung up in Massachusetts, who became offensive to the government, and its leaders were sentenced to banishment. They were welcomed by Roger Williams, and through his influence and that of Sir Henry Vane, who was then residing in Massachusetts, they obtained from the Narragansetts (March 24, 1638) the island of Rhode Island; and the colony of *Rhode Island* was thus founded.

The people of Providence Plantations and Rhode Island, excluded from the colonial union, had no chance of maintaining a separate existence without the powerful protection of the mother country; and, in 1643, Roger Williams was chosen to conduct a mission to England for the purpose of obtaining a charter. The affairs of the American colonies were at this time under the control of the earl of Warwick as governor-in-chief, assisted by a council of five peers and twelve commoners. Sir Henry Vane was one of these commoners; and chiefly through his influence a charter was granted, dated March 14, 1644, by which the two colonies were incorporated under the title of *Rhode Island*. When Williams reached Seekonk on his return, the river was covered with canoes to welcome him. But the danger was not over. In April, 1651, a commission was granted to Coddington for governing the islands of Narraganset Bay, and the two small colonies were again exposed to the risk of being dismembered and parcelled out between the adjacent governments. Williams, in conjunction with John Clarke, again returned to England; and in Oct., 1652, Coddington's commission was vacated, and the charter of Rhode Island confirmed. Williams returned in 1654; but Clarke remained, and obtained another charter in 1663, which still continues to be the constitution of Rhode Island. Williams died in April, 1683, at Providence. He is the author of 'A Key into the Language of New England,' London, 1643, 8vo. His other writings were chiefly controversial, in reply to Cotton and George Fox. In answer to a work of the latter, he published his 'George Foxe digged out of his Burrowes.'

(Bancroft's *History of the United States*, vol. i.; *Encyclopædia Americana*; *American Almanac*, 1835, 1837, 1841.)

RHODES, an island off the coast of Caria in Asia Minor, opposite to Cape Volpe, between the gulfs of Syme and Macri. The harbour of the city of Rhodes is in 28° 12′ E. long. and 36° 26′ N. lat., according to Niebuhr. Rhodes was inhabited in very early times, and the Greek poets have shown more than their usual ingenuity in inventing fables to account for the origin of its first settlers. Rhodes was called Ophiusa, Æthræa, Trinacria, and by other names, which are enumerated by Pliny (v. 31). Pindar, in one of the most beautiful of the Olympian odes, records the myth that it was raised by Apollo from the waves, like Delos. The earliest of its inhabitants were called Telchines, under which name it is probable that the Phœnicians, as the first introducers of civilization, are alluded to. It was successively occupied by the Heliadæ, Danaides, and other mythological personages.

Passing from these traditions, we recognise something of historical truth in the story of Tlepolemus, the son of Hercules, who is said to have colonised Rhodes after his father's death. He is named in Homer among those who led forces to the Trojan war from Rhodes. The poet, in the same passage, makes mention of the three antient towns of Rhodes, Lindus, Camirus, and Ialysus; and of a triple division of the island into districts attached to them.

A second migration from Greece to Rhodes, led by the Argive Althaemenes, took place about the same time as the great movement of the Ionians in the same direction, the date of which is fixed by Clinton (*Fasti Hellenici*) to 988 B.C. The three towns already mentioned, with the neighbouring continental cities, Cos, Halicarnassus, and Cnidus, formed a confederacy, which, after the exclusion of Halicarnassus, was called the Doric Pentapolis. Between this period and the first Olympiad, 776 B.C., the Rhodians had already shown that love of commercial and maritime enterprise for which they were afterwards distinguished, and had made voyages to distant countries. They founded the colonies of Rhode in Iberia, Gela in Sicily, Parthenope among the Osci in Italy; and nearer home, Corydalla and Phaselis in Lycia, and Soli in Cilicia.

About 660 B.C., the antient kingly form of government which prevailed in the island, as in other Dorian states, was abolished, and magistrates, called prytanes, probably substituted. Such offices were filled by the family of the Eratidæ at Ialysus, who were originally kings of that city. In the seventh Olympian ode, Pindar celebrates the Olympic victories of Diagoras, one of this race, speaks of the influence of his kinsmen in Ialysus, and cautions the citizens of that place against innovations. This was about 464 B.C., when it is probable that the Athenians, who were extending their sway over the Archipelago, had already interfered with the internal government of the island.

During the Persian and Peloponnesian wars there is very little mention of Rhodes. It must have declined, like Miletus and various maritime powers on the coast of Asia Minor, and most likely from the same causes. In the course of the latter war, the alternate subjection of the Rhodians to the Athenians and Lacedæmonians produced a corresponding change in the constitutions of their cities from oligarchy by turns to democracy; and this led to internal disorders, and to the expulsion of the two representatives of the Eratidæ. One of them however, Dorieus, who was recalled by Spartan influence, succeeded in replacing the government in the hands of the nobles. In 408 B.C., the city of Rhodes was founded, by collecting into one spot the inhabitants of Lindus, Ialysus, and Camirus; and from this time the history of the city is identical with the history of the island.

In 357 Rhodes reverted for a short time to the dominion of Athens, against which state it soon after formed a league with Cos, Chios, and Byzantium. The Social War ensued, and was terminated in 355, on the condition of the future independence of the Rhodians. No sooner had they succeeded in shaking off their distant enemy, than they experienced the dangerous influence of a near neighbour, Mausolus, king of Caria, who, in consequence of the assistance which he had afforded them in their war with Athens, obtained great power in the island, and joined with the oligarchy in oppressing the rest of the citizens. After his death, his wife Artemisia, having by a stratagem obtained possession of the Rhodian fleet, deprived Rhodes for a time of its liberty. A Carian garrison was placed in the Acropolis, and it is probable that to this period may be referred the excesses of Hegesilochus and his companions, who are described in a fragment of Theopompus quoted by Athenæus (lib. x., p. 444, Casaub.) as the establishers of a corrupt and debauched oligarchy.

These internal disorders led to a mixed form of government, in which, as far as we can gather from writers of antiquity, the elements of democracy and aristocracy were balanced.

Two chief magistrates, called prytanes, vested with great powers, and taking precedence of each other by turns for the space of six months, were appointed every year. There was a senate, all the members of which had a vote in the public assembly, and sat in alternate months in the senate and among the people. In the public assemblies the people voted by show of hands. According to Strabo, great care was taken of the poor; they were provided with corn, and maintained at the expense of the rich, who were subject to leiturgiæ for that purpose. The superintendence of the marine and other matters was managed on oligarchical principles: the good effects of a constitution so modified were shown by the cessation of internal disorders in the city from this time.

After the death of Artemisia, we find the Rhodians, in alliance with Athens, sending assistance to Byzantium against Philip of Macedon. Idrieus, king of Caria, seems to have claimed some sort of supremacy over them.

They submitted, like the rest of Greece, to Alexander the Great, but expelled his troops from their city after his death. At this period they attached themselves very strongly to Ptolemy Soter, and received great benefits from Egyptian commerce. When they refused to assist Antigonus in his war against that prince, his son Demetrius, surnamed Poliorcetes, was sent against them; and the first of the memorable sieges to which Rhodes has at various times been subject commenced. The courage of the defenders was only equalled by the ingenuity with which the assailants applied every engine of assault which the mechanical knowledge of that age could suggest.

After many struggles the Rhodians succeeded in repulsing this formidable enemy (B.C. 303), and made peace on the condition that they should be the allies of Demetrius against every one but Ptolemy. From this epoch we may trace the rapid ascendency of Rhodes. The old maritime powers of Greece having fallen to decay, the supremacy of the seas fell to the share of this island, and great commercial success and refinement in the culture of art were the immediate results. The celebrated colossal figure of the sun was made at this time from the sum raised by the sale of the war-engines employed against the city in the siege, and generously presented by Demetrius, after peace was made, as a tribute to Rhodian valour. This statue, of which Pliny (lib. 34, c. 7) has left an account, was begun by Chares, a pupil of Lysippus, and completed by Laches, both of Lindus. It was made of brass; the height is said to have been 70 cubits; the thumb was so large that few men could span it; twelve years were employed in making it. The notion that its legs rested one on each side of the harbour at Rhodes does not seem to be supported by any good authority, and modern travellers do not agree as to its site. After it had stood for 56 years, it was thrown down by an earthquake by which the buildings of the city suffered very much. Such was the commercial importance of Rhodes, that on this occasion the great princes of the day vied with each other in the munificence of their presents to repair its losses. Hiero king of Sicily, Ptolemy Euergetes, Antigonus Doson king of Macedon, Seleucus III., and the various inferior powers of Asia Minor came forward with ready zeal to serve a city whose fleets protected the seas against pirates and extended mercantile communication. The Rhodians (219 B.C.), assisted by Prusias, king of Bithynia, compelled the Byzantines to remit the duty which they had been in the habit of exacting from ships that passed through the Bosporus, and shortly afterwards protected Sinope against Mithridates IV., king of Pontus.

A new epoch in the history of this people is marked by the first direct mention of the interference of the Romans in their affairs. Rhodes joined Attalus, king of Pergamus, in his war against Philip III., king of Macedon. The Romans threw their weight into the scale against Philip, and entered into an alliance with the two powers that were attacking him. After his defeat at Cynoscephalæ, B.C. 197, the Rhodians joined Rome in a war with Antiochus, in which their navy was of great service. In gratitude to their new allies, the Romans gave them Caria and Lycia. From this time the prosperity of the city began to decline. Her recently-acquired continental possessions resisted her sway, and in their struggles appealing from time to time to the Roman senate, gave that body an opportunity of practising their usual policy of interference. During the war that followed with Perseus, king of Macedon, the Rhodians, in their internal factions mistaking their true interests, became the allies of that prince, but full of consternation at the news of his speedy defeat, 168 B.C., they submitted to Rome, and gave up their territory in Asia Minor. Their revenue was curtailed, and they experienced other marks of the displeasure of the senate. From this time till the Mithridatic war (84 B.C.), we hear little of them. They then gave important aid to the Romans by sea, and were in consequence attacked by the king of Pontus with a great armament, which they defeated. In requital for their fidelity, Sulla at the close of the war confirmed their liberty. During the contest between Pompey and Julius Cæsar they took the part of the former, but abandoned him after the battle of Pharsalia. They attached themselves to Cæsar from this time, and after his death, still supporting his partizans, drew down upon themselves the anger of Cassius, who seized the city, and severely punished the inhabitants, by taking away their ships and fining them heavily.

After the battle of Philippi, Rhodes was restored to freedom by Antonius, in the enjoyment of which its inhabitants remained till the time of Claudius, who, in consequence of the frequent revolts, withdrew some of their privileges, which however he afterwards restored. Finally, Vespasian incorporated this island in a Provincia Insularum, of which it was probably the seat of government. Here the antient history of Rhodes ceases.

In the brief sketch which we have here attempted, many interesting particulars have been necessarily omitted relating to the foreign policy, the commerce, the government, arts, manners, literature, and religion of the Rhodians, and characteristic at once of the Dorian race, of a maritime and trading people, and of the influence of an Asiatic climate on the physical and intellectual condition of the Greeks. The code of laws relating to their navy, adopted afterwards by other maritime states (see *Dig.*, 14, tit. 2, 'De Lege Rhodia'), the powers vested in the several branches of their executive administration, their sumptuary statutes, and regulations to protect their poor, all claim especial attention from the student of antient history. In their most flourishing age, their city, like Alexandria at the same period, was the place of resort of learned men from all countries, and a very similar style of literature sprung up in both places. We cannot indeed expect to find among the writers of these times the freshness of fancy and originality of thought of earlier Greece, but the spirit of research and critical inquiry was awakened, and great progress made in mathematics and other sciences.

Rhodes is particularly distinguished as the parent of a new style of oratory, which the antients considered of a mixed or Græco-Asiatic type. Such too was the character of their contemporary art, which seems to have delighted in executing gigantic and imposing conceptions. Besides the celebrated Colossus, three thousand other statues adorned the city, and of these 100, according to Pliny, were on such a scale that the presence of any one of them would have been sufficient to ennoble any other spot. The architecture of Rhodes was of the same stately character; the ground on which it stood sloped gradually to the sea, like the interior of an antient theatre. The plan, designed by the same architect who built the Piræus at Athens, was perfectly symmetrical, as much, Aristides remarks in his 'Rhodian Oration,' as if it had been one house. The streets were wide and of unbroken length, and the fortifications, strengthened at intervals with lofty towers, did not appear, as in other cities, detached from the buildings which they enclosed, but by their boldness and decision of outline heightened the unity and connection of the groups of architecture within. The temples were full of the finest paintings, the works of Protogenes, Zeuxis, and other artists of the school of Rhodes. The celebrated picture of Ialysus, by Protogenes, which was afterwards brought to Rome, was the object of universal admiration. The coins of Rhodes are numerous and of good workmanship. The most usual type is a radiated head of the sun, and on the reverse a flower which has been called that of the pomegranate, though on some of the coins it rather more resembles the rose, and thus may be considered as a type allusive to the name of the island, the Greek word *rhodon* (ῥόδον) signifying a rose. Spanheim in his great work on coins has given a long dissertation on the subject. Other deities that occur on the obverses on the coins of Rhodes are Jupiter, Neptune, Bacchus, and Serapis. The head of Medusa also is met with. The coins struck under the Roman emperors are given as late as the time of Commodus in Mionnet ('Description des Médailles Antiques: Rhodes'). The word TAMIA occurs on some of the *autonomous* coins: this is an interesting fact, as we have notices from other sources of the existence of such a magistrate at Rhodes.

A few scanty notices of Rhodes may be collected from the historians of the Lower Empire. After having been made by Vespasian into the head of a province, it afterwards formed part of the Thema of Cibyra, as appears from the work of Constantine Porphyrogennetus on the Themata.

In the reign of Heraclius (A.D. 616), Rhodes is mentioned among the conquests of Chosroo, king of Persia, but reverted to the dominion of the Greek emperors shortly afterwards. (Gibbon, vol. v., p. 626, Lond., ed. 1828.) In the caliphate of Othman, A.D. 651, it was taken by Moawiyah, one of his generals, and the fragments of the Colossus, which had been lying on the ground ever since its fall, were collected by the Saracens, and sold to a Jewish merchant of Edessa, who is said to have laden 900 camels with the weight of metal.

In the year 716 Theodosius III. was proclaimed emperor of the Greeks, in consequence of the revolt of troops in Rhodes against his predecessor Anastasius. The island had been probably abandoned by the Saracens before this date. We find it again forming a part of the Greek empire at the taking of Constantinople by the Latins, A.D. 1204, and in the general partition which then followed it was seized by some adventurer, whose name Nicetas Choniata, speaking of the circumstance, does not give.

Rhodes was not long after restored to the dominion of the Greeks, by John Ducas. At the commencement of the fourteenth century it seems to have been occupied by revolted Greeks and Mussulman corsairs, when (A.D. 1310) Fulke de Villaret, grand-master of the knights of St. John, carried into execution the design of his brother and predecessor Guillaume de Villaret, and made himself master of the island, which became from that time the place of residence of the Order, till their final expulsion in the sixteenth century. Five years after their settlement they sustained a formidable siege from Othman, the Turkish sultan, and, notwithstanding the unprepared state of their fortifications, succeeded in repulsing him, and a few years afterwards his son Orkan. From this period they continued to resist the constantly increasing power of the Turks, for about 200 years, adding to the advantages of a position naturally very strong the most skilfully designed fortifications that could be devised in the fourteenth and fifteenth centuries, and making the numerical superiority of the infidels of little avail, by their better organization in the field, more efficient weapons and armour, and incredible valour. In 1344, in the grand-mastership of Helcon de Villeneuve, they attacked and took Smyrna, which they maintained as an outpost. Three years afterwards they came in contact with a new enemy, the Sultan of Egypt, against whom they defended the king of Armenia. The project of removing the knights to Syria or the Morea having been abandoned at length by Innocent VI., they continued their enterprises against the sultan of Egypt, and making a sudden descent, plundered Alexandria, A.D. 1365, but did not make any permanent conquest in that country. At the close of this century the Order engaged in a league to check the increasing power of Bajazet, and sustained a severe loss at the fatal battle of Nicopolis. In 1401 Tamerlane deprived them of Smyrna. During the grand-mastership of John de Lastic, they carried on a war with the sultan of Egypt, which was terminated by a siege of Rhodes, lasting 40 days, in which the Saracens were repulsed with great slaughter. The Turkish empire having somewhat recovered from the effects of the invasion of Tamerlane, Mahomet II. laid siege to Rhodes in 1480, and, notwithstanding the immense force of artillery employed against it, could not take the place. The last and most memorable siege of Rhodes was June, 1522, by the Turks, conducted by their sultan Solyman II. The princes of Christendom, thinking probably that it was hopeless to attempt the defence of so distant an outpost, abandoned Rhodes to its fate, and its gallant inhabitants held out till they were nearly buried in the ruins of their fortifications. Their grand-master, Villiers de Lisle Adam, entered into a capitulation in December the same year, and evacuated Rhodes on honourable terms. The history of the Order from this time belongs to that of Malta. [MALTA.] The island has ever since remained a province of the Turkish empire.

The greatest length of Rhodes, from north to south, is about twelve leagues, according to Sonnini (*Voyage en Grèce et Turquie*), its breadth six leagues, and its circuit is commonly estimated at forty-four leagues. Strabo makes the circuit 920 stadia. On the western coast is the site of the antient Camirus. On the eastern, at the northern extremity of the island, is the city of Rhodes, to the south of which is Lindus, and a small river, the Camdura, below which is Cape Tranquillo, the southernmost point of the island. The whole of this side of the coast is indented by deep bays formed by projecting headlands, and capable of affording protection for shipping. Towards the centre of the island is the mountain Artemira, the Atabyris of Strabo, which commands a magnificent view of the Archipelago, the woodland scenery of the island forming a rich foreground sloping down to the coast, and the distance being bounded, on the Asiatic side, by the picturesque outline of the Lycian hills.

The air is mild and healthy, and fragrant from the number of orange and citron groves and of aromatic herbs. The statement of Pliny, that scarcely a day in the year passes without sunshine, is confirmed by the present inhabitants. The winds are chiefly north or north-west during almost every month; sometimes they blow with great violence. The soil is fertile, and there are numerous springs. The fig-tree and the vine still flourish, and corn is grown, though only enough for the consumption of the inhabitants. Antiently many articles of commerce were exported, which were in much esteem among the Greeks and Romans. Pliny and other authors mention glue, pitch, honey, and saffron ointment; but Turkish misrule here, as in the rest of the Levant, has counteracted the natural advantages of situation, climate, and products.

The population has been somewhat differently estimated. Savary, whose 'Lettres sur la Grèce' were published in 1788, reckons it at 37,500; in Fuller's 'Turkey,' a later work, it is put down at about 40,000; and in Turner's 'Journal of a Tour in the Levant,' 1820, it is thus stated:—14,000 Greeks, 5000 Turks, and 1000 Jews. There are, according to this last writer, forty-two Greek villages, and the rest are Turkish.

The inhabitants are governed by a bey, who holds his office for life, a circumstance which is favourable to the inhabitants, who are less oppressed than in other Turkish governments, where there is a more frequent change of masters. The bey farms the revenues and pays an annual sum of half a million of piastres every year to the Porte, besides fitting out a frigate every two or three years. Shipbuilding is the chief employment of the Rhodians.

At Lindo, or Lindus, there are ruins on an eminence near the sea, which Savary supposes to be those of the temple of Athena Lindia, the work, according to Strabo (p. 655. Casaub.), of the Danaides. The harbour is frequented by small craft, and the inhabitants carry on some trade. No remains of Camirus or Ialysus have been discovered.

Of the town of Rhodes there are no remains earlier than the time of the knights, but all their works are interesting specimens of the military architecture of the middle ages. On entering Rhodes from the sea, two harbours, separated by a narrow quay, present themselves; the larger, to the north, is called Mardraici, and the smaller is named the Port; the narrow quay which separates them forms a curve, having on its extremity next the sea a round tower, and farther inland a square one of great strength and crowned with turrets of observation at the four corners. According to Thévénot, this tower was built by the Turks, on the site of the tower of the same name so often mentioned in the sieges of Rhodes in the time of the knights. Attached to it is a curtain, which connects it with the fortification of the town within. From the other side of the smaller port a narrow quay juts out, on which is another round tower. The Turks have suffered the entrance to Mandraici to be so much obstructed as to impede the navigation.

The castle of the Order in the town, containing the cells of the knights in one street, the cathedral, with curiously carved wooden doors, and with the arms of England and France on its walls, was still in a very perfect state when Dr. Clarke visited the island in 1801, and it retained its portcullises and drawbridges.

This traveller speaks of it with great admiration, and Fuller ('Turkey') recognises the same style of architecture as that which he saw in the fortifications of the knights at Malta. There are remains of several other churches in Rhodes. The inhabitants of the higher classes live in the suburbs, which are very extensive and full of beautiful gardens; the Christians live in a quarter by themselves, called Villagio Novo.

For the antient history of this island, the dissertation of Meursius, which contains most of the passages in the classical writers relating to Rhodes, Müller's 'Dorians,' and a dissertation in Latin on the Macedonian period, by Paulsen, printed at Göttingen, may be consulted. For the modern history, see Vertot's 'Chevaliers de St. Jean,' Coronelli, 'Isola de Roda,' and other authorities which may be found in Meusel's 'Bibliotheca Historica.' A very curious work, by Gulielmus Caoursin, vice-chancellor of the Order, gives a history of its siege in 1480, with wood-cuts of the harbour and operations of the siege, printed at Ulm, by John Reger, 1490.

Other views of Rhodes may be seen in Dapper's 'History of the Archipelago,' translated into French from the Flemish, and in Lebrun's 'Travels.'

RHODEZ, or RODEZ, a city of France, capital of the department of Aveyron, 312 miles in a direct line, almost due south of Paris, or 356 miles by the road through Nevers, Moulins, Clermont, and St. Flour; in 44° 20′ N. lat. and 2° 33′ E. long.

This town is mentioned by Ptolemy under the name of (*Σεγόδουνον*) Segodunum, as capital of the Ruteni (*Ῥουτανοί*) a Celtic people, included in the enlarged province of Aquitania by Augustus. It subsequently took the name of Ruteni, from which have been derived both the modern name of the town, Rhodez, and that of the county of Rouergue, of which, in the middle ages, it was the capital. [ROUERGUE.] Rhodez had also counts of its own, whose dominions came into the hands of the counts of Armagnac, and were not finally united to the crown until the accession of Henri IV., who had inherited them.

The town stands on a considerable eminence on the northern bank of the Aveyron, 2173 feet above the level of the sea, and nearly 500 feet above the bed of the river. It is surrounded by antient walls, now converted into a terraced walk or garden. The streets, from the rapid slope of the hill on which the town is built, are steep; they are also narrow, crooked, dark, and dirty, lined with ill-built wooden houses with projecting upper stories, which are however being gradually displaced by others of better architecture. There are four 'places' or squares, two of them of tolerably regular form. The cathedral is for the most part Gothic, of the earlier part of the fifteenth century, but with some incongruous additions. The size of the nave, the boldness of the vaulted roof, the beauty of the stained-glass windows, and the height of the bell-tower (to which some writers assign an elevation of above 265 English feet) render it a striking edifice. The office of the prefect is a modern building; the other chief public buildings are, the college, built by the Jesuits, and the seminary for the priesthood.

The population of the commune of Rhodez, in 1826, was 7747; in 1831, 8249 (of whom 7879 were in the town); and in 1836, 9685. The inhabitants manufacture woollen yarn, coarse woollen cloths, serges and other woollen stuffs, hats, wax and other candles, and playing-cards. There are tan-yards and dye-houses. The trade of the place is in the manufactured articles, in the wool grown in the neighbourhood and the grey cloth made from it, and in cheese. There are four yearly fairs. Silk-worms are reared, and mules for the Spanish market bred round the town.

Rhodez is the seat of a bishopric, the diocese of which comprehends the department, and the bishop of which is a suffragan of the archbishop of Alby: it has several judicial and fiscal government offices, an exchange, a chamber of manufactures, an agricultural society, a departmental nursery-ground, and a public stud, an hospital, cabinets of natural history and of natural philosophy, a public library of 15,000 volumes, a deaf and dumb school, a school for outline drawing, a theatre, and public baths.

The arrondissement of Rhodez contains 183 communes: it is divided into eleven cantons or districts, each under a justice of the peace. The population, in 1831, was 94,568.

RHO'DIUM, a metal discovered by the late Dr. Wollaston, and named from *rhodon* (*ῥόδον*, a rose), on account of the colour of one of its solutions. This metal exists in combination with platinum. According to the analysis of Berzelius, the ore of Colombia contains nearly three and a half per cent., and that of Siberia only 1·15 per cent. of rhodium. When the greater part of the platinum and palladium have been separated from the solution of the native grains, a plate of iron is to be immersed in the residual solution, and by this the rhodium, with small quantities of platinum, copper, and lead, is thrown down in the metallic state. In order to render the rhodium pure, it is first digested in dilute nitric acid, which dissolves the copper and lead, and the rhodium and platinum are then to be dissolved in nascent chlorine (aqua regia) mixed with some common salt, and the solution is to be evaporated to dryness. By this operation there are obtained the double chloride of platinum and sodium, and rhodium and sodium. The former is to be dissolved in alcohol, and the latter afterwards in water, and a plate of zinc immersed in the solution precipitates the rhodium in the metallic state. The metal thus procured is in the state of a black powder, and requires the strongest heat of a wind-furnace for fusion.

The properties of rhodium are, that it is white, has a metallic lustre, is brittle, extremely hard, and its specific gravity is about 11. It is not dissolved by any acid or by nascent chlorine (aqua regia), except when it is alloyed by other metals; and this circumstance accounts for its being dissolved, when alloyed with platinum, in the native grains of this metal. It suffers no change by exposure to air, either dry or moist.

Oxygen and Rhodium.—These cannot be made to combine by direct action, and it is probable that the protoxide has not been insulated. When finely-divided rhodium, mixed with potash and a little nitre, is heated to redness in a silver crucible, the metal is oxidized, and becomes of a brown colour, and is mixed with potash; the mass is to be washed with water, and then treated with hydrochloric acid, by which hydrated peroxide of rhodium is left, of a greenish grey colour. It consists of about—

One and a half equivalent of oxygen .	12
One equivalent of rhodium . . .	52
Equivalent . .	64

When this peroxide is heated, it becomes black, and is then probably converted into protoxide, composed of—

One equivalent of oxygen . . .	8
One equivalent of rhodium . .	52
Equivalent . .	60

Chlorine and Rhodium probably unite in two proportions, but the perchloride only has been hitherto obtained in a separate state. It was procured by Berzelius by adding silico-hydrofluoric acid to a solution of the chloride of potassium and rhodium, as long as the double fluoride of potassium and silicium was generated, after which the filtered liquor was evaporated to dryness, and the residue redissolved in water. The remaining perchloride thus obtained has a dark brown colour, and when heated to redness, chlorine is evolved and metallic rhodium obtained. The aqueous solution of this salt is a fine rose-red colour, whence the name of the metal which it contains.

It is a sesquichloride, composed of—

One and a half equivalent of chlorine .	54
One equivalent of rhodium . .	52
Equivalent . .	106

This salt forms double compounds, called rhodio-chlorides, with the chloride of potassium and of sodium; they consist of one equivalent of each.

Sulphur and Rhodium may be made to combine by heating them together, the metal being in a state of minute division; it fuses at a white heat without decomposition, has a bluish-grey colour, a metallic lustre, and by the action of nitric acid is converted into sulphate of rhodium. Sulphuret of rhodium may also be formed by heating the amonio-chloride of the metal with sulphur, or by heating its solution with sulphuret of potassium.

Alloys of Rhodium.—When combined with steel to the amount of only two per cent., it gives the steel great hardness without occasioning it to crack under the hammer. Dr. Wollaston has examined several of its alloys, and, on account of its hardness, he suggested its employment for the nibs of metallic pens; to which purpose it has been applied successfully. It has not been combined with mercury.

Salts of Rhodium.—The salts of the peroxide only have been formed. Their general properties are but little known.

Nitrate of Rhodium is obtained by dissolving the peroxide in the acid: it is of a deep red colour, and uncrystalizable.

Sulphate of Rhodium is procured, as already mentioned, by acting upon the sulphuret with nitric acid. The solution is of a deep red colour, and does not yield crystals. When the caustic alkalis are added to the solution of this salt, a precipitate of the hydrated sesqui-oxide of a greenish-yellow colour is obtained after some time; the alkaline carbonates produce no effect, nor does sulphurous acid, nor the ferrocyanide of potassium. Hydrosulphuric acid throws down sulphuret of rhodium; but the hydrosulphates of ammonia and potash produce no immediate precipitate.

RHODOCRINI'TES. [ENCRINITES, vol. ix., p. 393.]

RHODODENDRON, a gênus of evergreen shrubs, very common in gardens, is one which differs from Azalea [AZALEA] principally in the stamens being 10 instead of 5, in the corolla being campanulate, not tubular, and in the foliage being hard and evergreen. The species are nearly related to each other, and occur both in the new and old worlds. Of the numerous varieties to be seen everywhere in flower in this country, in the months of May and June, the greater part belong to R. ponticum, a species found wild on the coasts of the Black Sea from the range of Caucasus through Armenia and Georgia to the western frontier of Persia, or to R. catawbiense, an American species, or to hybrids between these. R. ponticum was at one time supposed to be the plant which rendered the honey of Asia Minor poisonous; but it has been ascertained that the effect is really produced by Azalea pontica. In the warmer parts of India there occurs the tree Rhododendron, with crimson or white or pink flowers, one of the most beautiful of all trees, too tender to bear the open air in England, but a noble object in a conservatory; there are also some mountain species on the Himalayas, one of which, R. campanulatum, is strikingly handsome, and quite hardy. By means of crossing the crimson tree Rhododendron with some of the hardy species, a race of hybrids has arisen, which are much cultivated as hardy greenhouse plants, and in Ireland and some of the milder parts of England they will endure the open air without protection. They are perhaps more beautiful than any of their parents. The most curious of these hybrids is a yellow one recently obtained by Mr. Smith, a nurseryman near London, by crossing a Rhododendron with the yellow Chinese Azalea; this is perhaps one of the finest artificial productions yet obtained by florists. The Alpine Rhododendrons, hirsutum and ferrugineum, with small campanulate crimson flowers, are handsome dwarf shrubs in elevated situations, but they dislike the low grounds near London. The leaves of *R.* chrysanthum, a species with yellow flowers from Siberia, have a great reputation as a remedy for chronic rheumatism; its effects are those of a powerful narcotic.

RHODOMANNUS, LAURENTIUS, was born in 1546, at Sassawerft, on the estates of the counts of Stolberg. His parents were poor, and as the boy early displayed great talents, count Stolberg sent him at his own expense to the gymnasium at Ilfeld. Greek literature, which was then reviving in Germany, had most attractions for him, and he made it his principal study at the university of Rostock. After the completion of his studies, he held several offices as teacher, but was afterwards invited to the professorship of Greek literature in the university of Jena, and subsequently to that of history at Wittemberg, where he died on the 8th of January, 1606.

Rhodomannus is said to have been extremely ugly, but his learning and amiable qualities soon effaced the unfavourable impression created by his appearance. His greatest merits consist in his efforts to diffuse a taste for Greek poetry, and he endeavoured to attain this object by making Greek verses himself, in which he is said to have been very successful. We still possess a number of works by Rhodomannus, in Greek verse with Latin translations, viz.: 'Vita Lutheri, Græco carmine descripta et Latine reddita,' Ursel, 1579; 'Descriptio historiæ ecclesiæ, &c., Græco carmine cum versione Latina, e regione textus Græci,' Frankfurt, 1581; 'Poesis Christiana, id est, Palæstina, seu Historiæ Sacræ, Græco-Latinæ, libri ix.,' Marpurg, 1589; 'Theologiæ Christianæ Tyrocinia, carmine heroico Græco-Latino, libri v.,' Lipsiæ, 1597, &c. Rhodomannus also made some Latin translations of Greek authors, as of Diodorus Siculus, which is printed in the edition of H. Stephens (1604); of the 'Posthomerica' of Quintus Calaber; he also made a translation of extracts from 'Photii Bibliotheca' and Diodorus Siculus, under the title of 'Memnonis Historia de Republica Heracleensium et Rebus Ponticis Eclogæ,' Helmstadii, 1591, and reprinted at Geneva in 1593. Rhodomannus edited the following collection of Greek poems:—'Anonymi Poetæ Græci: Argonautica, Thebaica, Troica, Ilias parva, Arion, Narratio de Bello Trojano e Constantini Manassis Annal.,' &c., Lips., 1588. His Life has been written in Latin, by Ch. H. Lang, Lübeck, 1741.

RHODOPHY'SA. [Physograda, vol. xviii., p. 138.]

RHOEMETALCES. [Thrace.]

RHOMB, RHOMBUS, RHOMBOID. These terms have been used in various significations by different writers, and the second and third have been sometimes distinguished from each other in meaning. It is not worth while to do more than state, that when either of them is now used, it signifies an equilateral oblique parallelogram. The Latin dictionaries define rhomboides to be a parallelogram, and rhombus an equilateral parallelogram.

RHOMBOI'DES (Conchology), De Blainville's name for a genus described as bearing a resemblance to *Byssomya* in its shell, but as differing in the soft parts. *Mytilus rugosus*, Gmel.; *Hypogæa barbata*, Poli.

RHOMBUS (Conchology), De Montfort's name for a genus of *Cones*, of which *Conus nocturnus* may be regarded as the type. [Conus, vol. vii., p. 485.]

RHOMBUS MA'XIMUS. [Pleuronectidæ.]

RHÔNE, River. [France.]

RHÔNE, a department of France, the smallest except the metropolitan department of Seine, bounded on the north by the department of Saône et Loire, on the east by that of Ain, on the south-east by that of Isère, and on the south and west by that of Loire. Its form approximates to an oval, having its greatest length from north to south, from the neighbourhood of Aigue Perse in the Charolais mountains to Condrieu on the Rhône, 60 miles; and its greatest breadth at right angles to the length, from the neighbourhood of Lyon to near Panissière in the department of Loire, 28 miles. Its area is only 1080 square miles, being less than half the average area of the French departments, and about equal to the area of the English county of Durham. The population, in 1826, was 416,575; in 1831, it was 434,429; and in 1836, 482,024, showing an increase in the last five years of 47,595, or nearly 11 per cent., and giving more than 446 inhabitants to a square mile. In amount of population it exceeds the average of the departments in the proportion of nearly 4 to 3; and in density of population, in the proportion of nearly 3 to 1; in amount of population it exceeds every English county except Yorkshire, Middlesex, Lancashire, Devonshire, and Surrey; and in density of population, every one except Middlesex, Lancashire, and Surrey. Lyon is the chief town. [Lyon.]

The western side of the department is mountainous; the Lyonais, Beaujolais, and Charolais heights, which form the prolongation northward of the Cévennes, extend through it on this side from south to north. From a point in the north of the department near the town of Beaujeu, these heights send off two offsets, one (the Mâconnais heights) to the north-north-east, which are separated from the principal range by the valley of the Grône, a feeder of the Saône; and another to the south-south-east, which are separated from the principal range by the valley of the Azergue, another feeder of the Saône. In the south of the department another offset branches off from the main range, from which it is separated by the valley of the Brevanne, and extends north-east to the banks of the Saône, north of Lyon; its extremity is known as Mont d'Or, a name which is sometimes given to the whole branch. The extremity of another branch running to the north-east and separated from the main range by the valley of the Gier, just extends into the southern part of the department. Some of the peaks are of considerable height; the mountain of Tarare is on the north side about 2600 feet, in the centre nearly 3000 feet, and on the south nearly 4500 feet. The Mâconnais heights have in some places an elevation of above 3000 feet. The principal pass over these mountains is that of Tarare, where the road from Paris by Moulins to Lyon crosses the ridge. Southward of this are the passes through which run the roads from Lyon to Feurs and to St. Etienne; northward of it the only pass in the department is that through which runs the road from Beaujeu to Charlieu. The road from Lyon along the western bank of the Rhône runs in several places through a narrow pass between the lower yet rapid slopes of the mountains and the river.

The principal mass of the mountains is composed of granitic or other primary rocks. In the valley of the Gier are found the lower secondary formations; while the valley of the Rhône is occupied, in the north, by the secondary formations, and in the south by the super-cretaceous or tertiary formations.

The mineral wealth of the department, though of various kinds, is not of any great value. There was only one coal-mine worked in 1834 (one had been given up); it produced 7577 tons of coal, valued at 3881*l.*: the quantity of coal produced in the department in 1835 was 7463 tons. Three mines produced lead in 1836, but the quantity was only 6 tons, valued at 98*l.*: two produced a small quantity of copper. The copper-mines are at St. Bel near Arbresle on the Brevanne, and at Chessy on the Azergue: they were worked by the Romans. Rock crystal, porphyry, granite, fine marble of various colours, sandstone, gypsum, potters' and fullers' earth, manganese, and excellent freestone are found. Some particles of gold are brought down by the Rhône. There are some chalybeate waters at Charbonnières near Lyon, but not of much importance.

The principal range of the mountains which we have described separates the basin of the Rhône from that of the Loire; the eastern slope being in the former, the western in the latter. As the ridge is not far within the western boundary, almost all the department is included in the basin of the Rhône, only a small part of the western side being in that of the Loire. The Saône touches the eastern boundary of the department, about 10 miles below Mâcon: this river or the Rhône forms the eastern boundary to Condrieu adjacent to the southern extremity of the department, except just in the neighbourhood of Lyon, where the department extends across so as to comprehend a portion of the eastern bank of both rivers. The affluents of the Saône are, the Grône, of which only the source and just the upper part of the course are in this department, the Ardière, and the Azergue. The Azergue receives the united streams of the Brevenne or Brevanne and its feeder the Tardine. The feeders of the Rhône are the Izeron, the Garon, and the Gier, of which last only the lower part belongs to the department. Of the feeders of the Loire, the Sornin, the Trambouze, the Loise, and the Coize have their sources in this department. None of these rivers are navigable except the Saône and the Rhône.

The only canal is that of Givors, which extends along the valley of the Gier from Rive de Gier to Givors. The length of water communication is given in the official statements as follows:—

Saône	38 miles.
Rhône	32 „
Rivers	70 miles.
Canal of Givors	6 „
Total	76 miles.

There are six government roads, having an aggregate length (1 January, 1837) of 146 miles, viz. 111 miles in repair, 12 miles out of repair, and 23 unfinished. The principal roads are those from Paris to Lyon. The road by Auxerre and Châlons (with which the road by Dijon unites) enters the department on the north side, and follows the valley of the Saône through Villefranche and Anse. The road by Moulins enters the department on the west side, and runs by Tarare and Arbreslo. From Lyon two roads run, one across the Alps to Chamberi and Turin; the other along the valley of the Rhône (by the east or left bank) to Avignon, and thence to Aix, Marseille, Toulon, and Genoa; but only a very small portion of these two roads is in the department. Roads also lead from Lyon by Grezieux, Izeron, and Rivoire to Feurs in the department of Loire, and thence to Clermont-Ferrand; by St. Genis-Laval and Brignais to Rive de Gier and St. Etienne, in the department of Loire; and along the valley of the Rhône, branching off from the St. Etienne road at Brignais, and passing through Millery, Givors, and Condrieu to Le Pont St. Esprit, Nîmes, and Montpellier. The departmental roads had an aggregate length of 169 miles, viz. 105 in repair, 18 out of repair, and 46 unfinished. The bye roads and paths had an aggregate length of above 1500 miles. There is a railroad from Lyon to St. Etienne, and one from St. Etienne to the Rhône at Givors, a branch (we presume) of the other.

The climate is healthy, but the temperature is various, owing to the varying elevation of the surface. This inequality is unfavourable to cultivation upon a large scale. The surface may be estimated in round numbers at 700,000 acres; of which about 360,000 acres, or more than half, are under the plough. The banks of the Saône are remarkably fertile, and much wheat is grown there. The grain harvest is abundant, but, from the density of the population, altogether insufficient to supply the wants of the inhabitants. Pulse, colza, madder, millet, saffron, flax, and hemp are also cultivated. The meadows comprehend 90,000 acres; the heaths and open pastures, about 30,000. Neither horses nor oxen are numerous, or of a good breed; the number of cows is very great, approaching 50,000. Sheep are numerous. Asses are both numerous and good; and on Mont d'Or a number of goats are fed, from whose milk good cheese is made. The vineyards occupy above 75,000 acres; some of the finest wines in France are produced here, especially the Côte Rôtie, Romanèche, Ste. Foy, and Condrieux. The fruits both of northern and southern France are grown, except the orange and the olive; and the chesnuts are sent to Paris and sold under the name of Lyon chesnuts. The mountains are for the most part covered with wood: Mont Pilat in particular is covered with fine firs: the woodlands occupy about 85,000 acres.

The waters furnish a good supply of fish. The pike, the eel (some of great size), the barbel, excellent trout and perch, and other fish, are taken in the streams; and the shad, the lamprey, and the sturgeon ascend the Rhône. The eel-pouts of the Saône are excellent.

The department is divided into two arrondissements, as follows.—

Name.	Situation.	Area in sq. m.	Cantons.	Communes.	Population. 1831.	Population. 1836.
Lyon .	S.	500	16	126	292,370	330,044
Villefranche	N.	580	9	127	142,059	151,980
		1080	25	253	434,429	482,024

In the arrondissement of Lyon are—LYON; St. Genis-Laval; Millery, population 1500 for the town, 1525 for the whole commune; Givors, population 4385 for the town, or 4884 for the whole commune; Ste. Colombe; and Condrieu, or Condrieux, population 3090 for the town, 3864 for the whole commune, are all on or near the Rhône. St. Andéol is near the Gier, Riverie and Mornant between the Gier and the Garon, Brignais on the Garon, Izeron on the Izeron, Grezieux on the road from Lyon to Clermont, Arbreslo near the junction of the Tardine and the Brevenne, St. Laurent and St. Bel near the Brevenne, Montrotier near a feeder of the Brevenne, and Chesseay or Chasselan and Neuville on the Saône; all these are in the basin of the Rhône, east of the Lyonais mountains. On the west side of the ridge, in the basin of the Loire, are St. Simphorian and Rivoire. St. Genis-Laval is a handsome little town, with a 'place,' or square, planted with trees. The townsmen manufacture paper-hangings, paper-stainers' colours, printers' ink, writing ink, buttons, carpets, banners, and paintings for churches. Considerable trade is carried on in wine, of which some very good is grown in the neighbourhood. There are five cattle-fairs in the year. Considerable trade in wine is also carried on at Millery. Givors, standing at the junction of the canal of Givors with the Rhône, and at the terminus of the railroad from St. Etienne, is a busy town, in a fertile and pleasant district. The townsmen manufacture window-glass, glass bottles, and drinking-glasses, and dye silk. There are three yearly fairs for nails, glass, and cattle. At Condrieu, or Condrieux, the townsmen carry on manufactures of silk and leather, dye silk, and refine salt: they carry on trade in corn, and in the much esteemed white wines of the neighbourhood. There is a good weekly cattle-market, and there are six yearly fairs. A considerable number of the inhabitants are boatmen on the Rhône, and many boats are built here. At Mornant coarse woollen cloth and hats are manufactured; there are four yearly fairs. Brignais has the ruins of an aqueduct, supposed to be of Roman construction, and several handsome country-houses belonging to the inhabitants of Lyon. Some trade in cattle is carried on, and a good deal of wine is grown round the town. Near Izeron, sometimes written Yzeron, fine granite is found. An antient Gothic castle of picturesque and imposing appearance distinguishes Arbresle. The town itself is modern, having been rebuilt after a destructive inundation in 1715. Some cottons are manufactured at St. Laurent, and there are copper-mines at St. Bel, but so unprofitable that it has been proposed to give up working them. At Neuville, distinguished as Neuville l'Archevêque, cotton-yarn is spun, silk thrown, linen bleached, and paper and sheet-lead made. There are seven yearly fairs.

In the arrondissement of Villefranche are—Villefranche, population in 1831, 6460; in 1836, 7553; Belleville; and Anse; all near the Saône; Chamelet, Yoingt, Bois d'Yoingt, Chessy, Châtillon, and Chazay, on or near the Azergue; Tarare, population 5990 for the town, 6833 for the whole commune; Beaujeau, population 1520 for the town, or 1596 for the commune, on the Ardière; and Jullie, near the northern boundary of the department: all these are in the basin of the Rhône. West of the Lyonais and Beaujolais mountains, in the basin of the Loire are the towns of Amplepius, population 4873, and Thizy, on feeders of the Trambouze; and Aigueperse near the northern frontier. Villefranche was founded, near the end of the eleventh century, by Humbert, Sire de Beaujeu. The town consists of one very wide and handsome street, extending for above a mile along the road from Paris to Lyon, and of some smaller streets branching from it. The houses are well-built. The inhabitants manufacture cotton yarn, cotton goods, and leather. There are three yearly fairs, and a considerable weekly market for cattle, chiefly for the supply of Lyon, hemp, flax, cotton yarn, and cotton and hempen cloth. Considerable trade is carried on in hides and wine. There are some subordinate government offices, judicial and fiscal; a high school, and hospitals. There were formerly lead-mines near the town, which were worked by the Romans. Belleville, distinguished as Belleville sur Saône, has a manufacture of muslins and other cottons, also of linens: trade is carried on in wine. The town lies just out of the road from Paris by Mâcon to Lyon. Anse is agreeably situated in one of the richest plains in France, at the foot of a hill covered with vineyards. Linen-bleaching is carried on at Chamelet. Yoingt has the ruins of an antient castle, the chapel of which now serves as a parish church. Chessay has important copper-mines, and works for smelting and rolling the copper. Tarare, in a narrow valley at the foot of Mount Tarare, over which the road from Paris by Moulins to Lyon has been carried with great labour, is a tolerably well-built and very busy town. It is the centre of a manufacture of muslin and embroidery, which employs 50,000 workmen scattered over the neighbouring country: it has print-works, bleach-grounds, tan-yards, and potteries; there are two yearly fairs. The neighbouring mountain contains lead-ore, but the mines have been given up marble is quarried. The town has at times suffered considerably from the swelling of the little river Tardine, on which it stands. Beaujeu, the antient capital of Beaujolais, is a neat town, at the foot of a mountain crowned with the ruins of the old castle of the Sires de Beaujeu. There are cooperages, paper-mills, and tan-yards. A considerable trade is carried on in grain, wines, and iron, and in the cottons and linens manufactured in the district round. It has six yearly fairs. At Amplepius and Thizy linens and cottons are manufactured; and at Cours, a large village near Thizy, a mixed fabric of cotton and flax is woven. There are twelve fairs at Thizy, which is the mart for the surrounding country.

The department constitutes, with the adjacent department of Loire, the archiepiscopal diocese of Lyon and Vienne: it is in the jurisdiction of the Cour Royale of Lyon, and the authority of the Académie Universitaire of that city. It is in the nineteenth military division, the head-quarters of which are at Lyon. It sends five members to the Chamber of Deputies. In respect of education it is above the average of France; of the young men enrolled in the military census of 1828-29, 45 in every 100 could read and write; the average of the departments being under 40.

The district now included in the department was antiently part of the territory of the Segusiani (*Σαιγοσιανοὶ* and *Σεγοσιανοί*, Strabo), a people dependent on the Aedui, and perhaps of the Insubres (*Ἰνσουβροι*, Strab.), who appear to have been either dependents of the Aedui or a part of their nation. It is probable that the bank of the Saône above Anse belonged to the Ambarri, also dependents of the Aedui; the neighbourhood of Beaujeu appears to have been comprehended in the territory of the Aedui (*Αἰδουοὶ* and *Ἐδοῦοι*, Strabo; *Αἰδουοι*, Ptol.) themselves; and the bank of the Rhône south of Givors belonged to the Allobroges (*Ἀλλόβρογες*, Strabo; *Ἀλλόβρυγες*, Ptol.). These nations all belonged to the great Celtic stock. This part of Gaul was the seat of contest in Cæsar's war with the Helvetii, in the first year of his command in Gaul. The Rhône and the Saône were known to the antients by the names of Rhodanus (*Ῥοδανὸς*, Strabo) and Arar (*Ἄραρ*, Strabo).

In the Roman division of Gaul, this territory was included in the province of Lugdunensis, afterwards of Lugdunensis Prima; except the portion which belonged to the Allobroges, which was included in Narbonensis, the 'provincia nostra' of Cæsar, and upon the subdivision of that province, in Viennensis. A few towns, Roman or Celtic, were included in its limits. Lugdunum (*Λούγδουνον*, Strabo and Ptolemy), now Lyon, the most important, is noticed elsewhere. [Lyon.] The Mediolanum of the Peutinger or Theodosian Table is fixed by D'Anville at Meys, a village near the western boundary of the department, between Lyon and Feurs; the Assa or Asa Paulini of the Antonine Itinerary may be fixed at Anse; and the Lunna of the same authority was somewhere upon or near the northern boundary of the department, between Lyon and Mâcon.

On the overthrow of the Roman empire it passed into the hands of the Burgundians and Franks. In the middle ages it constituted part of the counties or provinces of Lyonais in the south, and Beaujolais in the north, so called from their chief towns Lyon and Beaujeu; and both subdivisions of the province, to which, in a more extended sense, the name of Lyonais was given. [Beaujolais; Lyonais.] When France was first divided into departments by the National Assembly, A.D. 1790, this department, with the adjacent one of Loire, formed one department under the name of Rhône et Loire. The separation was afterwards made by the National Convention.

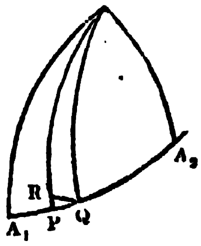
RHUBARB. [Rheum.]

RHUMB or RUMB. Vitalis (*Lex. Math.*) calls this a Portuguese word, and no doubt it might have been introduced into navigation by the Portuguese, but we suspect it to be the Latin 'rhombus': he says it signified originally the meridian, or the principal meridian of a map; perhaps it came to signify this from such meridian being usually ornamented by a distinctive rhombus, such as is added to the north direction on a compass-card. However this may be, a rumb certainly came to mean any vertical circle, meridian or not, and hence any point of the compass; so that, in modern phraseology, a rumb is one of the thirty-two principal compass directions, and to sail on any rumb is to sail continually on one course. Hence a rumb-line is a line drawn in the sphere, such as would be described by a moving point which always keeps one course; it is therefore the spiral described in Mercator's Projection, and is that which is also called the loxodromic spiral.

The mathematical properties of the rumb-line may be easily deduced. Let r be the radius of the earth, λ_1 and l_1 the longitude and latitude of A_1, and λ_2 and l_2 those of A_2, λ and l being those of any intermediate point P: and let s be the length of A_1P. If then we increase s by the infinitely small arc ds, increasing λ and l at the same time by $d\lambda$ and dl, we have the differential triangle PQR, in which $PQ = ds$, $PR = rd\lambda$, $RQ = rdl \,.\, \cos\lambda$, while the angle RPQ, which is the same throughout the curve, may be called ρ. We have then $ds \,.\, \cos\rho = rd\lambda$, or $s \,.\, \cos\rho = r(\lambda - \lambda_1)$ integrating from A_1 to P. Again, $ds \,.\, \sin\rho = rdl \,.\, \cos\lambda$, so that the two equations give

$$\frac{d\lambda}{\cos\lambda} = dl\cot\rho, \quad \text{or } \log\cot\left(\frac{\pi}{4} - \frac{\lambda}{2}\right) = l\cot\rho + C;$$

the logarithm being Naperian, and the angles being measured as in Angle, vol. ii., p. 23. If L be the length of the arc of a degree of longitude at the equator, and if we now use degrees, and extend the preceding integration from A^1 to A_2, we have—



$$r\log\frac{\cot(45^\circ - \frac{1}{2}\lambda_2)}{\cot(45^\circ - \frac{1}{2}\lambda_1)} = (l_2 - l_1)\,L\cot\rho;$$

an equation from which ρ can be found for any two places, that is, the angle which the course in sailing from one place to the other makes with the meridian. And instead of $r : L$ may be put its value 57·29578. The distance from one place to the other on the rumb-line sailed over may be found from $s\cos\rho = r(\lambda_2 - \lambda_1)$, which, when λ_2 and λ_1 are measured in degrees, becomes $s\cos\rho = (\lambda_2 - \lambda_1)\,L$, neglecting the small correction for the earth's excentricity.

The first of these processes can be done by Mercator's chart, the principle of which, mathematically described (with which the popular description given in Mercator's Projection agrees), is as follows:—Let equal arcs of longitude remain equal throughout the map, but as increments of latitude are to their corresponding increments of longitude as 1 to the cosines of the latitudes, let the differential triangle PQR be similar in the chart to that on the sphere, which gives $ad\lambda : \cos\lambda$, for the representation of $d\lambda$ on the chart, provided a represent the length of the degree of longitude on the chart. Hence $a\cot(45^\circ - \frac{1}{2}\lambda)$ is the length of λ degrees of latitude measured from the equator; and a table of values of $\cot(45^\circ - \frac{1}{2}\lambda)$ is called a table of *meridional parts.*

In such a chart all rumb-lines are projected into straight lines; but equal parts on any such straight line do not represent equal distances on the earth: and the distance sailed must be found by the formula in terms of the extreme latitudes and the angle of the course.

RHUS (Sumach, in Greek *ῥοῦς*), the name of a genus of plants. One of the species, *R. cotinus*, appears to have been known to Pliny, who refers to its dyeing properties, and its place of growth, the Apennines, under the name of Cotinus. (Plin., *Hist. Nat.*, xvi. 18.) This genus has an extensive geographical range, from the south of Europe to the Cape of Good Hope. It is also found in Asia and North and South America. It belongs to the natural order Anacardiaceæ, and to the tribe Sumachineæ. Most of the species are poisonous, but they are much cultivated as ornamental shrubs, especially on account of the beautiful red colour of their leaves in autumn. Many of them are used also for the purposes of dyeing and tanning; as an astringent principle, to which is frequently added an acid, is common to the whole genus.

The genus *Rhus* has the following characters:—Flowers bisexual, or polygamous; calyx small, persistent, five-partite; petals five, inserted under the margin of the disk, imbricate in æstivation; stamens five, hypogynous; ovary one-celled, sessile; fruit, a dry drupe; seeds solitary, exalbuminous; radicle opposite the hilum, and bent downwards along the edge of the cotyledons. Leaves alternate, simple, or compound; panicles axillary or terminal.

De Candolle enumerates about ninety species, to which other writers have made additions, but there is reason to believe that many of the new species are merely varieties. We shall here enumerate only a few of those which have interest on account of being cultivated, or their uses in medicine and the arts.

Rhus cotinus, Venus Sumach, or Wild Olive. Flowers hermaphrodite, arranged in loose panicles of a greenish yellow colour; leaves simple, entire. This is a very ornamental shrub, and is one of the European species, growing wild in various districts of the south of Europe. It is made use of, like many other of the species, for tanning, in Italy, and is called *Scotino*. The wood is used by the modern Greeks for dyeing wool, which is said to be of a beautiful rich yellow. It is frequently cultivated on account of its beauty. It requires a dry loam, and is best propagated by pegging down the branches flat to the ground and strowing earth over them, by which means the young shoots, when they grow up, may be removed in the following autumn.

Rhus typhina, Fever Rhus, or Stag's-Horn Sumach. Leaves with eight to ten pair of leaflets and an odd one, lanceolate, acuminate, serrated, pilose beneath. There are two forms of this plant: the one, *arborescens*, in the form of a tree, from ten to twenty-five feet in height; the other, *frutescens*, shrubby, and only from two to ten feet high. The young shoots are covered with down, which, with their somewhat crooked and stunted branches, give them the appearance of young stags' horns; hence their name. The flowers are in dense spikes, at the ends of the branches, the pistilliferous ones developing themselves into woolly drupes, which are very conspicuous when ripe. It is found in every part of North America, and its dark red leaves add much to the beauties of an American autumn. The fruit of this plant is exceedingly sour, and on this account it is frequently called *vinegar plant*, and is even used in some parts as a substitute for vinegar.

Rhus glabra (Smooth-leaved Sumach).—Leaf like the last, but broader and glabrous. Branches also glabrous. Fruit red, covered with silky hairs. Three forms of it are distinguished by De Candolle: *hermaphrodita*, with hermaphrodite greenish flowers; *dioica*, with diœcious green flowers; and *coccinea*, with diœcious red flowers. This last form is the *Rhus elegans* of the nurseries and gardens. This species, as well as another named *R. viridifolia*, is considered by some botanists as only a variety of *R. typhina*. Like the last, this species is abundant in North America, overrunning sometimes a whole district, and forming a troublesome weed. Its fruit is very sour, but may be eaten with impunity. Bees are very fond of the blossoms.

Rhus vernicifera (Varnish-bearing Sumach, or Japan Varnish-tree).—Leaf with 5-6 pairs of leaflets, all ovate, long, acuminate, entire, glabrous above, velvety beneath. It is a native of Japan and Nepaul. Its leaves are very large and beautiful, rendering it one of the handsomest of shrubs. According to Thunberg, this is the plant which yields the celebrated Japan varnish. The varnish is obtained from those branches of the plant which are about two or three years old, by cutting into them, when it oozes out. It is at first white, and of the consistence of cream, but it gets black in colour and much thicker after a little exposure. It is exceedingly transparent, and when used a dark surface of finely powdered charcoal or other substance is placed underneath it. It is very hard, cracking and flying like glass. The Japanese use this varnish very extensively, applying it to their door-posts, windows, household furniture, and in fact to everything made of wood.

Rhus venenata (Poison Sumach, or Swamp Sumach). Leaf 6-7 pair of leaflets, almost glabrous, entire, lanceolate-acuminate, reticulated beneath. Fruit white. It is a native of North America from Canada to Carolina, and also in swampy districts in Japan. This plant is exceedingly poisonous, so virulent that it is said to affect some persons by merely smelling it. A touch will sometimes produce violent inflammation. It is a beautiful shrub, and well worthy of cultivation, but great care should be taken to prevent its being carelessly handled.

Rhus coriaria (Hide or Elm-leaved Sumach). Leaf 5-7 pairs of villous leaflets, elliptical, bluntly and coarsely toothed, petioles naked. Flowers in large loose panicles of a whitish-green. Drupes villous. This plant is a native of the south of Europe. It is extensively used for the purpose of tanning, and it is said that all the leather made in Turkey is tanned with the bark of this species of Rhus. The fruit is acid and astringent, and the seeds are often used as tonics for exciting the appetite.

Rhus copallina (Gum-Copal or Mastich-leaved Rhus).—Leaf glabrous above, slightly pilose beneath, 5-7 pairs of leaflets and an odd one, lanceolate and entire. Petiole winged and jointed. Root creeping. Flowers yellowish-green, diœcious. It is a native of North America from New Jersey to Carolina. It attains a height of four or five feet. The leaves of this or a similar plant are stated (Don, *Gard. Dict.*) to be used for smoking instead of tobacco by the Indians of the Mississippi and Missouri. It is supposed to yield the gum-copal of commerce, from which copal-varnish is made.

Rhus radicans (Rooting Poison-Oak, or Sumach).—Leaf one pair of leaflets and an odd one, odd one petiolated, glabrous, entire. A native of America from Canada to Georgia. Its climbing habit, combined with the beautiful red colour of the leaf during the decline of the year, renders it one of the most picturesque of American plants. It frequently abounds in the forests, where it may be seen covering the tops of the highest trees. It climbs up walls and rocks, and runs upon the ground with equal facility, thus covering everything withing the reach of its stems. De Candolle distinguishes three varieties: *vulgaris*, with a stem climbing by means of roots; *volubilis*, climbing without roots; and *microcarpa*, with fruit much smaller than the other two. Like the following species, it emits a juice which indelibly stains linen. It is equally poisonous with *R. venenata*. A detailed account of the effects of the poison of the genus Rhus may be seen in Professor Kalm's 'Travels in North America.'

Rhus toxicodendron (Common Poison-Tree, or Poison-Oak).—Leaf of one pair of leaflets and an odd one, with a petiole, inciso-augulate, pubescent. Flowers greenish. It is found in woods, fields, and fences, in common with the last-named species, in North America, where they are both known by the same name. Many botanists consider the two only varieties of the same plant. This species is the type of the genus Toxicodendron of Tournefort. It was introduced into England in 1640, and first grown in the bishop of London's garden at Fulham. This species is that which is most frequently used in medicine.

The less common species of this genus cultivated in Britain are *R. pumila* (Dwarf Sumach), *R. viridiflora* (Green-flowered Sumach), *R. pentaphylla* (Five-leaved Sumach), *R. suaveolens* (Sweet-scented Sumach), and *R. aromatica* (Aromatic Sumach). There are also a great number grown in hothouses, many of which may probably bear exposure to the open air.

RHUS TOXICODENDRON (Trailing Poison-Oak, or Swamp-Sumach), a north-American shrub, possessed of peculiar properties. The leaves, which are trifoliate, thin, shining when fresh, of a dark-green colour, are the only parts officinal in this country. But the leaves, branches, and flowers contain a milky juice which blackens on exposure to the air, and may be used as an indelible ink when applied to cotton or linen. Besides this very acrid milk, the plant, when not exposed to the sun's rays, by growing in the shade, or during the night, exhales a hydrocarburetted gas, which acts very potently on persons of a peculiar susceptibility, when exposed to it. In two or three days after touching or being very near the plant, the skin inflames and swells, being attended with intense burning pain. If the face be affected, the eye-lids are so tumefied as to close up the eyes; and the whole head is swelled and covered with little blisters containing serum. Occasionally the whole body is enormously swollen and covered with similar vesicles. When the inflammation and swelling have subsided, the skin desquamates, and an intolerable itching is felt for several days afterwards. These symptoms closely resemble erysipelas, and are moderated by treatment suited to that complaint. Professor Barlow states that the best application is a weak aqueous solution of bichloride of mercury. All persons however should avoid touching any sumach which has milky juice.

The leaves, or an extract of the inspissated juice of this plant, have been recommended in several diseases, particularly herpes, paralysis, and consumption. It is little used in this country, but it appears entitled to some confidence in local paralysis, such as that of the jaw. It must be given with caution, as large doses act like narcotico-acrid poisons.

The bark of Rhus glabrum is said to furnish a most effectual means of checking salivation.

RHYME. Johnson's derives this word from the Greek *rhythmus* (ῥυθμὸς). Others derive it from the Swedish and Danish *rim*, the Dutch *rym*, and the German *reim*. All the principal European nations use the same word to signify the same thing. Thus, the French have *rime*, the Italians *rima*, and the Spaniards *rima*. The Greek and Roman poets did not use rhyme, and the word rhythmus was applied by both, in its poetical meaning, to the metrical arrangement of syllables, and not to the correspondence of sound in their terminations. Rhyme was not used either by the Celtic or by the early Scandinavian nations. Thus the Irish and Erse poems on which Macpherson founded his 'Poems of Ossian' are without rhymes, as is also the Scandinavian poem of the 'Lodbrokar Quida' (Lodbroc's Death-Song). Rhyme, as an accompaniment of verse, cannot be traced farther back among European nations than to the *rymours* of Normandy, the *troubadours* of Provence, the *minnesingers* of Germany, and the monks, who, after the fall of the Roman empire, added rhyming terminations to the Latin metres which were chanted or sung in the church service. Rhyme was early employed by the Italian poets. The 'Divina Commedia' of Dante, the oldest of the great Italian poems, is in alternate rhymes. The early Spanish ballads sometimes have rhymes, sometimes only assonances [Assonance], and sometimes, as in the old Spanish romance of 'The Cid,' are without either rhyme or assonance. The early Anglo-Saxon poetry is without rhyme, but it is sometimes used in the later. All the old English poetry has rhymes, which are rude and imperfect, like the versification, but they are obviously an adjunct to the verse which could not be omitted.

Perfect rhymes arise from the identity of sound with which different words terminate—the identity, not the similarity. In monosyllables, or words which have the accent on the last syllable, to constitute a perfect rhyme it is necessary that the sound of the last accented vowel and of any letters which may follow it should be exactly the same as those of the word with which it rhymes. The sounds which precede the last accented vowel must be different in the two words. The spelling is of no consequence; the rhyme is in the sounds, not in the conventional signs by which the sounds are expressed. Thus *no* rhymes to *so*, but not to *do*, which rhymes to *too* or *two*; *great* rhymes to *hate*, but not to *heat*, which rhymes to *fleet*; and so on. If the sounds of the last vowels or of any of the following consonants differ in any degree, however small, the rhyme is so far imperfect; thus, *love* and *move* form an imperfect rhyme, the sound of the o in love being not only shorter than that of the o in move, but to a certain extent different. These monosyllable or last-syllable rhymes are called male rhymes.

Another class of rhymes is formed from words in which the accent is on the last syllable but one. In this class it is requisite that the sounds of the last vowel in the last syllable but one and of all the following letters should be the same as those with which they rhyme. Thus *desiring* and *respiring*, *descended* and *extended*, are perfect rhymes of this class. These are called female rhymes.

The principle of rhyming, once understood, the application is easy in all cases. Thus, if the accent is on the last syllable but two, the sound of the last vowel of the last syllable but two, and of all the following letters, must be the same. Thus, *sensible* and *extensible* are perfect rhymes of this class; but *dissolute* and *resolute* are imperfect rhymes, the vowels in the last syllable but two of both words having different sounds.

The same principle of rhyming applies to all the modern languages, as well as to the English. Imperfect rhymes are more or less freely used in all of them according to circumstances. The English and German languages, which abound in consonants, and have for the most part consonant terminations, are more deficient in rhymes than the Italian and Spanish, which abound in vowels, and have for the most part vowel terminations.

The English use blank verse as well as rhyme in the ten-syllable measure, but they have not been successful in the omission of rhyme in any other of their forms of verse. There have indeed been a few attempts in lyric measures, of which Collins's 'Ode to Evening' and Southey's romantic poem of 'Thalaba,' may be taken as favourable specimens. The Germans have been more successful in their unrhymed lyrics. The Italians and Spaniards have lyric measures of all kinds, both with and without rhymes. The French have been quite unsuccessful in their attempts to introduce blank verse in any of their measures.

RHYNCHÆA. [Scolopacidæ.]

RHYNCHASPIS. [Ducks, vol. ix., p. 178.]

RHYTHM. [Oratory.]

RHYTHM (Ῥυθμός, *measure, proportion*), in Music, is *Time*; first, in a limited sense, as in the relative proportions of notes in a single bar; and, secondly, in a more general sense, as in the relative proportion of a number of bars in any given portion of a composition, as in either half of a minuet or of a march. Rhythm is the most important constituent of music; without it inarticulate sounds are unproductive of any musical effect. [Music, p. 20, col. 2.] In melody, that is, a succession of measured sounds, notes are the component parts of a bar, and bars are the component parts of a strain, or musical period, or phrase. The due relative proportion of all those is absolutely necessary in the formation of a good musical composition; without it, says one who seems to have possessed a most discriminating and refined taste in the art,—

> 'How sour sweet music is
> When time is broke, and no proportion kept!'
> *Richard II.*

Musical *Rhythm*, in its limited sense, divides a bar into 2, 4, 8, &c. or 3, 6, 12, &c. equal parts; the former is *binary* measure, the latter *ternary*. In its more general sense it divides a strain, a phrase, or by whatever name the subdivisions of a composition may be designated, into equal portions of 2 or 4, &c. or 3, 6, &c. bars, or measures; and some writers have admitted a rhythmus of five bars. An intimate acquaintance with the nature of rhythm, whether considered in its relation to music or poetry, is essential to the accomplished composer; without a full knowledge of this he is perplexed by doubts, and guilty of errors which have too often brought reproaches on the art, when they ought to have fallen on the pseudo-artist. Our limits however will not allow us to extend this article; and we refer the reader, particularly the professional one, to a learned and able disquisition on rhythm in Burney's 'Hist.,' vol. i., p. 71; to Callcott's 'Musical Grammar,' where much practical information from Riepel and other German writers is to be found; to Kollman on 'Harmony;' and more especially to Reicha's 'Traité de Mélodie,' second edition, Paris, 1832, a very luminous work, the production of a highly-informed, deep-thinking, and truly scientific musician. [Phrase; Time.]

RIASAN, or **RJASAN** (sometimes written *Räsan*), is an extensive government of European Russia, which derives its name from the very antient town of Riasan, which indeed has long since fallen into ruins, but the name has been transferred to the town of Pereslawl. It is situated between 53° and 55° 40′ N. lat., and between 38° 18′ and 41° 30′ E. long., and is bounded on the north by Wladimir, on the east and south-east by Tambow, on the south-west by Tula, and on the north-west by Moskwa. The area is nearly 16,000 square miles, according to Reymann's map, which is followed by Hassel, Stein, Cannabich, and Schubert; but Hörschelmann and Köppen make it only 14,850 square miles. The population, in 1838, was 1,241,000. It is divided into twelve circles. The country is traversed by many small hills and eminences, and the banks of the rivers are high. No large rivers run through it, but there are many smaller ones. The surface is diversified with little forests and groups of trees. It is only on the banks of the Don, the Osetr, and the Prona that the elevations are rocky; the other eminences consist of beds of stone, clay, marl, and lime, and are by no means unfruitful. The soil in general is a pretty thick layer of fine black mould. The wastes are susceptible of cultivation, but they are much neglected. The principal rivers are the Oka, which flows from the government of Moscow, and the Don, which issues from lake Iwanowskoe, on the frontier, both of which rivers receive smaller streams. The greater part of the canal is in this government, which joins the Bakowa, a tributary of the Prona, which flows into the Oka, and the Lernoi, which flows into the Woronesh, a tributary of the Don, thus making a communication between the Wolga and the Don by the Oka and the Woronesh. But this canal seems to be of little use, because the above small rivers are not navigable by boats except in spring, when the water is high. There are no large lakes. In autumn, winter, and spring the weather is variable, and in summer hot. The climate is healthy.

The soil is on the whole very fertile, especially in the southern part, where it is drier than in the northern, which contains some marshes. Rye, wheat, oats, barley, millet, flax, and hemp are cultivated. There is not only sufficient corn for home consumption, including large quantities used in the distilleries, but even in moderately productive years a considerable surplus for exportation. Horticulture is very general; every peasant has his kitchen-garden, where all kinds of Russian culinary vegetables are grown, especially cabbages, which in some seasons weigh from 35 to 40 pounds. Most of the peasants grow hops, which are an article of exportation. Apples and cherries are the fruits chiefly cultivated. There is sufficient wood in the southern parts, and abundance in the northern circles. On the banks of the rivers there are meadows covered with the most nutritious grasses, and good pasturage in the forests. In the plains or wastes too there are large tracts very well suited for sheep-walks. The breeding of cattle might therefore be more extensively carried on than it is; but the farmers let their pasture-land to the cattle-dealers of the Ukraine. A farmer has generally two or three horses, three or four cows, and five to ten Circassian sheep. Few swine are kept, and no domestic poultry except the common barn-door fowl. Bees are very generally kept. Fish abound in the rivers, and great quantities are exported. There is little game of any kind, but the number of quails is remarkable; many thousands are killed in the autumn, which are salted, and sent in small barrels to all parts of the empire. The minerals are iron-stone, clay, marl, lime, a little free-stone, gypsum, vitriol, and sulphur.

There are few manufactures of any importance, and those chiefly in the towns. The country-people spin thread and worsted yarn, and manufacture coarse linen and woollen cloths, leather in considerable quantities, wooden agricultural and domestic implements and utensils, and bast shoes. The brandy distilleries are numerous. The exports of the government consist in the surplus of its natural productions, and of its manufactures, especially leather. Almost all the exports go to Moscow, from which it receives in return such articles as it has need of, except salt, which it obtains from the banks of the Wolga.

The inhabitants are all Russians, except a small number of Mordwins, who live in a few villages, and between 4000 and 5000 Tartars, who live partly in the town of Kasimow, and partly in some villages. The archbishop of Riasan and Saraisk is at the head of the Greek clergy. He has 6 monasteries and 841 parishes under him. The Mohammedan Tartars have their imams, mosques, and teachers.

Riasan, the capital of the government (formerly called *Pereslawl Riäsanski*), in 54° 58′ N. lat. and 39° 20′ E. long., is situated on the river Trubesch (a branch of the Oka) at its junction with the Lebeda. It is a well built town, not fortified, but only surrounded with palisades. It is the residence of the military governor of Riasan and Tambow, of the civil governor and the government authorities, the see of the archbishop, and has a seminary for priests, a gymnasium, 20 churches, and manufactories of woollen cloth, linen, sailcloth, leather, glass, and iron-wares and needles. There are about 9000 inhabitants.

Saraisk on the Osetr has 5000 inhabitants, 8 churches, and a great trade in cattle. Kasimow on the Oka and the Babinka, has 10,000 inhabitants, of whom 500 are Mohammedan Tartars, who carry on a great trade in furs.

RIBALTA, FRANCISCO, was born at Castellon de la Plana in the kingdom of Valencia in Spain, 1551. It is thought by some that he at first formed his style by studying the works of Juan Batista Juanes, whose works adorn many of the churches at Valencia, and some of his pictures appear to favour that position. But he subsequently visited Italy, where he resided some years, and there seems to have acquired a taste for the style of Sebastian del Piombo, of many of whose pictures, in the royal collection at Madrid, he made copies, three of which are in the convent of the Carmelites in that city. In an inscription on one of these pictures in the hospital of Montserratte at Madrid, he calls himself the translator of Sebastian:

> 'Fra Sebatianus del Piombo invenit;
> Franciscus Ribalta Valentiæ traduxit.'

He died at Valencia in 1628, aged 77. His best works are at Valencia.

RIBALTA, JUAN, son of the above, was born at Valencia in 1597. He was the pupil of his father, and in his eighteenth year painted a picture of the Crucifixion, which is still numbered among the master-pieces of the Spanish school. He would probably have attained the highest eminence in his art, had he not been cut off in the flower of his age. He died in the same year as his father (1628), in the 31st year of his age.

RIBAND, or, according to the common orthography, **RIBBON**, signifies a long narrow web of silk worn for ornament and use. Ribbons of linen, worsted, gold, or silver thread were formerly included in the term, but it is now generally confined to those made of silk. Johnson derives the word from the French *ribande* or *ruban*, which Skinner, in his 'Etym. Ling. Angl.,' imagines to be formed from the Latin particle *re* and the Saxon *bind* or *bende*, thus meaning to double or tie back. According to others, it is derived from *roux*, red, and *bande*. Alfonso XI., king of Castile, instituted in 1332, for the younger sons of noble houses, the order of the Band, which was a *red* ribbon worn over the right shoulder and under the left arm of the knight. The word *band* is common to all the Teutonic languages; whether allied in its origin to the low Latin *bandum* (an ensign), the Cambro-britannic *bannar* (a standard), or to the Saxon *bend* (anything that binds), is disputed. Ribbon, in German, is *band*; Danish, *baand*; Swedish, *band*, Dutch, *lint*; Russian, *lenta*; Spanish, *cinta*; Portuguese, *fita di seta*, from the Latin *vitta*; Italian, *del nastro*, *fettuccia*.

Webster maintains that 'ribbon' has no connection with *band*, but that it is of Welsh origin, from *rhibin*, a row or streak; Irish, *ruibin*; Armoric, *rubanou*; French, *ruban*. Conformably with this opinion, he writes the word *ribin* in his 'Dictionary,' a mode of writing which represents the vulgar pronunciation as well as that of Sheridan—*ribbin*. Chaucer, in the fourteenth century, speaks of 'ribaninges,' meaning apparently borders.

Whether, in its origin, the name of ribbon were a *banner* or a *band*, or neither, the ribbon has served in the cause of both love and war in its subsequent history:

> 'See, in the lists they wait the trumpet's sound,
> Some love device is wrought on every sword,
> And every ribbon bears some mystic word.'—*Granville*.

The knight went forth 'to do or die,' strong in the badge of scarf or ribbon received from his ladye love, while, twined in a true-love knot, it cherished her constancy at home. The village swain buys a ribbon at the fair to adorn his sweetheart's rosy cheek; the young recruit walks proudly under the gay-coloured knot fastened to his ploughman's hat; and the veteran commander arrays himself in the ribbons of his orders. The white ribbon wedding-favour is the emblem of innocence and happiness, while a green, a blue, or an orange cockade is the herald of strife to a town, a county, or a nation.*

There can be no doubt that silk was early wrought into ribbons, and that they formed a branch of the silk manufacture during its progress from Greece to Sicily, and from thence to Italy and Spain; but the ribbon trade seems first to have assumed distinct importance in France. Louis XI. is supposed to have made the first successful attempt to produce silk in his kingdom; he planted mulberry-trees, and in 1480 settled some Italian silk workmen at Tours. Under Francis I. and Henri IV. the manufacture advanced rapidly. It was established at Lyon by the former in 1521, by means of some Milanese artisans, whom he prevailed upon to fix themselves there under his patronage; by the latter monarch it was established at Paris, and, amongst other encouragements, he promised patents of nobility to such of the manufacturers as should have persevered in it for twelve years. 'France, until this time,' observes the 'Encycl. Méthod.,' 'was an agricultural and commercial nation; since then the silk manufacture has contributed to extend both the one and the other.'

Paris, Tours, Lyon, and Avignon were the chief seats of the ribbon trade; the two last cities were rivals until the year 1723, when, partly owing to the regulations which the jealous Lyonnese had prevailed upon the government to make in their favour, and partly to a plague of two years' continuance, the trade of Avignon was ruined, and in great measure transferred to Lyon. At Paris the master ribbon-weavers were incorporated into a company, under the designation of *tissutiers rubaniers* of the town and suburbs of Paris: they were also styled, together with the makers of gold and silver ribbons and galloons, fringes, borderings, &c., *ouvriers de la petite navette* (shuttle), in contradistinction to the makers of broad stuffs of gold, silver, and silk, who were entitled *ouvriers de la grande navette.* Figured ribbons were made chiefly at Paris. The 'Encyclopédie des Sciences,' &c. states that, about the year 1680, there was a rage for ribbons *gauffrés*, or embossed, on account of their novelty. The stamping was performed by hot plates of steel, on which a pattern was engraved, being applied successively along the piece. A master-weaver named Chandelier, tired of this slow process, contrived a machine which would save his trouble. He engraved his figures on two cylinders of steel, between which, when heated, the ribbon was compressed and drawn rapidly by a simple machinery, so that a piece of ribbon was embossed in less time than his brother-workmen consumed over a single ell. 'The genius and invention of this weaver had their recompense —these ribbons *gauffrés* made his fortune.'

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* By an act 7 & 8 Geo. IV., c. 37, candidates at elections are forbidden to give ribbons or cockades or any distinctive marks to their voters, under a penalty of 10*l*.

The ribbons called *double lisse*, (double warp) which were considered the richest and best, were made at Tours. Before the revocation of the Edict of Nantes, the ribbon-looms of Tours amounted to 3000; but this measure, which banished the Protestants, banished with them their trade, and both Tours and Lyon suffered severely from its effects; the trade of Lyon afterwards revived. Savary, inspector-general of French manufactures, in his 'Dictionary,' published in 1723, says, that the trade in ribbons was much diminished in his time: he also remarks—'It may seem strange that in London, where they excel in this sort of fabric, they give the preference to the Parisian ribbons, while at Paris, as if in compensation, there is a sort of rage for the English, although those of Paris are not very inferior.' This was likewise the case at the time when the importation of ribbons was prohibited in both countries—an instructive commentary on the wisdom of such prohibitions—although, some time previous to the date of the first edition of the 'Dict.,' English ribbons were admitted on paying a duty of 4 francs per lb. In the 'Encycl. des Sciences, &c.,' published in 1765, there is the same complaint of the decline of the ribbon manufacture in France, but still the consumption was large, and large quantities were exported. In the enumeration of the different kinds of ribbon, a double satin is mentioned, that is, one alike on both sides in texture, although sometimes of different colours.

The 'Encycl. Méthodique' (1784) estimates the number of French looms employed in ribbons, galloons, &c. at 12,000, and gives the following amongst other information on the subject:—The ribbon manufacturers bought their silk already dyed. The price of the dyed Italian organzine was from 52 to 57 livres per lb. of 15 ozs.; of tram, from 30 to 40 ditto. The wages of the engine-loom weaver were from 40 and 50 sous to 3 livres per day. The kind of ribbon called *ruban Anglois* was composed of organzine warp and China shoot, both of fine quality. These ribbons, being light in texture and dressed with care, possessed a brilliancy which caused them to be much in favour. The ribbons of Paris were then esteemed the best in make, but Lyon, with its neighbours St. Etienne and St. Chamond, supplied the largest quantity. The chief markets for the best qualities were Francfort, Leipzig, Lübeck, Petersburg, and England, notwithstanding the prohibition; for the inferior, Italy and Spain. Figured ribbons were made in Flanders, the Lower Rhine, Germany, and Switzerland. Ribbons formed the principal commerce of Basel; many of the Swiss ribbons, though inferior, were sold for those of St. Etienne when the demand at that place exceeded the supply. Plain ribbons were made largely in Spain, at Saragoza, Seville, Murcia, Granada, &c., and brocaded at Valencia. In speaking of Lyon, this writer observes, 'that by the novelty, freshness, and elegance of its designs, it has long held and will long continue to hold the empire of taste. It has originated the most ingenious machines to facilitate the operations of its arts, and from thence have they been carried out over the world. The manufactures of Switzerland, Germany, Spain, and even of Petersburg, were set on foot by Lyonnese or by apprentices from them. The English alone appear to owe us nothing on this score. They have invented, copied, or imitated almost all kinds of silk goods, and if they do not always equal the French taste and delicacy, they keep up the qualities with a steadiness which results from the employment by the manufacturer always of the same material for the same purpose, and from the keeping of the workman always to the making of the same kind of fabric.'

The making of ribbons and small articles in silk long preceded in England that of broad silk. The trade was principally in the hands of women; and, like a sickly plant of foreign growth, it appears to have constantly demanded props and support. In the reign of Edward III., an act was passed to prevent artificers from using more than one trade or mystery, the silk-women and other female artificers being exempted from its operation. In the same year, 1364, an enactment was made for the regulation of apparel, by which none under the degree of esquires of 200*l.* of yearly rent, and their ladies, with some few exceptions, were permitted to wear stuff of silk, silver, ribbons, girdles, or furs. By an act of Henry VI., nearly one hundred years later, 'for the encouragement of silkwomen and throwsters,' it was forbidden to import wrought silk, ribbons, laces, &c., under a penalty of 5*l.*, the act to continue in force for five years. This was renewed in the third year of Edward IV., with a sort of apology, which, if good for anything, made the prohibition unnecessary. The act states that not only were the artificers, men and women, 'greatly impoverished, hindered of their worldly increase and daily living, by these wares and chaffres being brought in fully wrought and ready for sale by strangers, the king's enemies, and other,' but that 'the greatest part in substance was deceitful, and nothing worth in regard of any man's occupation and profit.'

The next sumptuary act forbids the wearing of silk by persons not possessing more than 40*l.* per annum. The increased consumption of silk is shown in the lowered qualification, and at the same time a striking proof is given of the shortsightedness of legislative interference on such points; with one hand the government strove to hold up the trade by shutting out foreign supply, with the other to check the home demand. By acts passed in the first and second years of Philip and Mary, the lower classes and servants, upon whom it appears the prohibition had now descended, were forbidden to wear silk on hat or bonnet, &c., under pain of imprisonment for three months and forfeiture of 10*l.*

The law against the importation of ribbons, &c. was renewed at successive intervals until the 19 Henry VII., when it was made perpetual. Foreign ribbons notwithstanding still made their way over, and we find another attempt to check the trade in an order of Charles I., which forbids any silks to be imported under the breadth of nine nails and a half. A proclamation of this king in 1630 furnishes us with another example of the blunders that legislation is apt to make in such matters:—'Seeing that the silk trade was enlarged to the enriching of the kingdom, and setting many thousand people to work, unless the deceitful handling thereof do bring the same into discredit, and thereby deprive the land of so hopeful a trade when it hath near attained the perfection thereof, and whereas it hath lately been discovered that a notable abuse hath crept in by adding to the weight of the silk in dyeing, it is commanded that no dyer should henceforth, now or at any future time, use any slip or alder-bark, or iron-filings, and no silk be dyed of any black but Spanish black, and that the gum shall be fair boiled off before dyeing.' Being however afterwards 'better informed,' and finding that taffeties, some kinds of ribbons, and other articles required to be made of hard silk, or silk dyed upon the gum, this part of the ordinance was rescinded, in a subsequent proclamation dated 1638. (Rymer's *Fœdera.*)

The silk-throwsters were incorporated by a charter obtained 5 Charles I., about ten years after the establishment of the broad-silk manufacture, in the reign of James I.: the silk-weavers were already included in the great company of weavers. Towards the end of the reign of Charles II., the silk manufacture, which had hitherto been almost confined to London, was carried into several other large towns of the kingdom by the French Protestants, who took refuge in this country, to the number, it is said, of 70,000, after the revocation of the Edict of Nantes in 1685, and amongst the rest to Coventry. Camden tells us that 'the wealth of Coventry arising in the last age from the woollen and camblet manufacture made it the only mart of this part, and more resorted to than could be expected from its midland situation.' The ribbon trade, of which it has since become the chief seat in England, was introduced early in the last century by Mr. Bird, assisted probably by some of the French emigrants: the number of French terms still used in the manufacture proves that its origin was, in part at least, foreign.

After the treaty of Utrecht, in 1713, French and Italian manufactured silks were admitted under considerable duties; but in 1765 the ribbon and other silk manufacturers procured the re-establishment of the prohibitory system, which was thenceforward maintained for sixty years, enforced by heavy penalties. With the increase of population and the greater demand for luxuries, the home market increased; but an export trade, principally to America, gradually decayed, in consequence perhaps of the heavy duties on raw and thrown silk. During this period of restriction, ribbon-weaving seems to have degenerated in this country as regards the superior branches. In a petition to parliament from the Weavers' Company, in 1713, against the commercial treaty with France, it is asserted that the English ribbons were as good as those of the French. It was stated by a Coventry manufacturer to the Commons' Committee on the Silk Trade, in 1832, that he had seen 'patterns of ribbons made from fifty to a hundred years ago in England, wider, richer, and of larger figure than were made just prior to the introduction of French ribbons in 1826.' (Question 866.) Most of the specimens adduced by the Spitalfields manufacturers who were then examined in proof of their assertion that our silk-weaving needed no instruction from French patterns, were of a like early date. On this occasion it was generally assumed that English ribbons were inferior to French. Recollecting also the observation of the French writer, at a time still farther back, 'that the Parisian ribbons were not very inferior to the English,' we are led to ask why English industry and skill have not in this instance maintained their accustomed superiority, and to suspect that they have been repressed rather than stimulated by the system of prohibition.

In 1824 the government determined to try the effect of an approach to free trade upon the silk manufacture. As a preliminary step, the duties on raw silk were reduced from 4*d*. per lb. to 3*d*., and afterwards to 1*d*.; and on thrown, from 14*s*. 8*d*. to 7*s*. 6*d*., and afterwards to 3*s*. 6*d*., 2*s*., and 1*s*. 6*d*., according to quality, with a drawback to the amount of the duty allowed on any manufactures of silk exported, whether they were or were not made of the foreign thrown silk which had paid the duty. Two years were allowed after the lowering of these duties to prepare for the admission of foreign manufactured silk at a duty of 30 per cent. During this interval the reduced price of silk stimulated the Coventry trade; the market was brisk; considerable capital was embarked to meet the increased demand, even in those branches which would inevitably suffer the most from French competition, and consequently an accession of hands was drawn into the manufacture. There were 5 Jacquard looms in Coventry in 1823; in 1832 the number had increased to 600. This period of two years was virtually prolonged for one or two more, by an exclusion of the goods prepared for our market in 1826, in consequence of an after regulation which required the pieces to be of the English lengths. As those differ from the French, the full force of foreign competition was not felt until 1828. A reaction then took place in Coventry as elsewhere; deep and loud were the complaints of masters and workmen, and the distress among the latter was great.

Besides the shock which the change even from a worse to a better system must occasion, unless prepared for by all parties with extraordinary prudence and foresight, and besides the vicissitudes to which all trades are subject, that of ribbons is peculiarlyliable to fluctuation from the caprice of fashion. A demand suddenly arises, continues for one, two, or more seasons, and requires the employment of many new hands; it ceases as suddenly, and they are thrown out of employ. Wages are reduced, starvation threatens the workman, and it is not surprising that he should petition that his labour may again be rendered available by shutting out that of others abroad or at home.*

A Committee of the Commons was appointed in 1832 to inquire into the state of the silk-trade, at which such of the leading ribbon manufacturers as disapproved of the late measure, and also some of the weavers, attended. They were unanimous in demanding a total prohibition. 'Nothing short of this could enable them to make ribbons at all.' (Qu. 1844.) 'The inveterate *prejudice* in favour of French fancy ribbons made nugatory the protecting duty; it was not a matter of 'price, but of fashion.' (Qu. 2420, 2495.) Smuggling, which had not even diminished since the legalised entrance of French goods, would in all probability increase under a renewal of restriction; but 'smuggling to a certain extent was beneficial, for it furnished the manufacturers with patterns.' (Qs. 447, 737, 738, 846.) With total prohibition then was demanded a more vigilant preventive service, and severe personal penalties on smuggling, whilst the hope was still entertained that after all ribbons enough would be smuggled to furnish patterns and styles. By this expensive apparatus the capitals embarked in the fancy trade *might* be protected, provided that the public, when they could not get their favourite French article, should not give up the use of fancy ribbons altogether. The duty was allowed to be a sufficient protection against the French plain ribbons, the English being so nearly equal to them in quality; and several of the manufacturers admitted that some improvement had taken place in the fancy goods since the entrance of their foreign rivals. The partner of a London house largely concerned in the trade asserted that this improvement was very considerable, and that the stimulus of foreign competition was required. It was conceded by one of the manufacturers in his evidence, that although patterns had been obtained by smuggling before the removal of the prohibition, they had formed no idea until then of the extent of the French manufacture, nor of the style and fashion that would be introduced. (Qu. 803.)

This inquiry led to no alteration in the system which the government had adopted, and two further remonstrances made by the same parties in 1833 and 1834 had a similar result.

That France possesses some advantages over us in this peculiar fabric is undoubted. These advantages consist in the superior cultivation of taste—even the weavers may be seen arranging the flowers of a nosegay, so as to produce the most beautiful combinations—in the growth of its own silk, some of which, from the Cevennes, is the finest in the world from its peculiar brilliancy; and in the cheapness of labour, the cost of which is on an average about half that of the English. In their gauze ribbons these advantages unite with peculiar effect; the fine white silk, the exportation of which is not allowed, the greater proportion in them of labour to material, and the elegant variety of which they are susceptible, constitute them, in the words of the English weavers, 'a more natural manufacture of France, as hardware and cottons are a more natural manufacture of England.' It appears just that these advantages should exchange with each other, and it must not be forgotten that these gauzes must be paid for by British labour in some shape or other.

The English throwsters in 1817 petitioned the government to take off the duties on raw silk, in the expectation of exporting thrown silk, as this country now exports cotton yarn. Mr. Doxat gives it as his opinion that the throwster in England does his work cheaper, relatively, than in France or Italy, and has the command of a greater variety of silk. It appears from the evidence of Dr. Bowring, laid before the committee of 1832, that the French themselves expect that, from the superior capital and machinery of our throwsters, English thrown silk will soon be imported into France. He also states that the impression in France was so strong that the English silk fabrics had greatly improved since 1826, that considerable alarm was felt on the subject, and a high authority at Lyon expressed his belief that it would be better to prohibit the export of silk goods to England. English silks are not now prohibited in France, as they formerly were, and upon the whole the silk manufacture has been less 'protected' there than almost any other, and it appears to have prospered partly for this reason; all foreign silks are admitted into France at a duty of from 13 to 15 per cent. The importation of English manufactured silk into France was in 1828 to the amount of 4699*l*.; in 1830, 24,810*l*.; in 1838, 56,598*l*.

According to Dr. Bowring, in 1831, the number of ribbon manufacturers at St. Etienne and St. Chamond was 200. The number of ribbon looms in these towns and the surrounding district, which in 1812 was 9000, had increased to 23,000. Their daily produce was 350,000 ells. There are three kinds of looms in use: 1st, the old unimproved single-hand looms called *basselisse*, employed for plain satins and sarsnets; they were 18,000 in number, and are used by weavers who engage themselves in agriculture when there are 'no orders' in the town. 2nd, the single-hand loom called *hautelisse*, generally applied to produce large patterns;

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* Note. 'It was estimated, before the admission of French goods, that the number of hands then in the trade could have produced in nine months, if fully employed, the whole of the year's sales of Coventry manufacturers, and this permanent excess of hands was aggravated to an 'awful depression' by the first brunt of French competition. During a slack time one-third or more of the single hand looms, and a very large proportion of the engine-looms, especially those in the fancy trade, always have been out of work, but in this case it is not the *same* looms that are unemployed during the whole slack time.'—(J. Fletcher, Esq., *Report on the Hand-loom Weavers.*)

of these there were 600, 100 having the Jacquard machinery attached. 3rd, the *à-la-bar*, or *bar loom*, 5000 in number, of which 800 were employed in sarsnets, 200 in velvets, 700 sarsnet galloons, 800 stout and light satin, 2000 Jacquard, and 500 striped gauzes. Two-thirds only of these were actually employed. The proprietor of the looms, who receives the work from the manufacturer, is called the *passementier*; he gives half the price paid for the weaving to the *ouvrier*, who is the weaver. The lowest daily earnings of the last were equal to about 1*s.*, the highest to 3*s.* 8*d.* There is a list of prices for weaving agreed upon amongst the manufacturers of St. Etienne, as there is at Coventry. Goods are not made on speculation, the trade being conducted by orders.

At Lyon a recent contrivance, by which the broad-silk loom had been made applicable to ribbon-weaving, had brought back a portion of the trade which had almost deserted it. By the introduction of 4 small shuttles instead of one, 4 pieces of ribbon were woven at once. There were 800 or 900 looms, chiefly Jacquard, and from 30 to 40 single-hand employed for the richest goods. The value of the French ribbons exported in 1831 was about 936,945*l.*, of which England took 75,147*l.*, the United States 472,678*l.* The whole annual value of the ribbons manufactured in France in 1832 was estimated by Mr. Dillon, in his evidence before the silk committee, at 1,300,000*l.*; in England, from 800,000*l.* to 1,000,000*l.*

The Swiss exchange their inferior ribbons for the superior ones of the French; their sarsnets are now superior to those of St. Etienne. They have an advantage in the manufacture, as they pay no duty on the silk, and the manufacturer is generally his own importer, throwster, and dyer. There were about 3200 looms at Basel in 1831, principally for plain goods. Switzerland is entirely free from protective duties. (Dr. Bowring.) Large quantities of Swiss ribbons came in on the opening of our trade, but they could not enter into competition with the English in quality or price, the cost of transport being considerable.

At the present time there are few if any ribbons made at Lyon; many of the looms which had been converted into ribbon-looms being now employed in weaving shawls.

The silk manufacture was established in Dublin about the same time as at Spitalfields by the French Protestants. Ribbons were made there in considerable quantities. In 1824 the number of ribbon-engine-looms amounted to 996. The trade seems to have laboured under still greater inherent disadvantages than that of the English, one of which was that the price of silk was enhanced to the manufacturer by the additional charges consequent upon its transmission through London. When exposed to British competition by the withdrawal of the protecting duties which existed before the Union, and soon after to that of the French also, the trade sunk beneath the shock, and is now almost annihilated, a fact which proves that its growth was unsound and premature. The influx of the distressed Irish silk-weavers to Coventry, Macclesfield, and other places increased the number of unemployed hands in those towns. The Irish manufacturers made precisely the same remonstrances against the free admission of English silks which those of England did against the importation of the French. (Commons' Committee, 1832.)

After a period of ten years the result of French competition appears to be this—an increase in the consumption of ribbons altogether owing to the beauty and taste of the French ribbons. These create the fashion and supply the highest market, while Coventry has a collateral trade among the middle and lower classes, which extends with the other. This is proved by the fact that although the importation of French ribbons has increased with the increasing acquaintance of the foreign manufacturer with the English market, the number of looms has augmented in Coventry; in 1838 more ribbons were made there than in any one year before. At the close of the last war, when an extraordinary demand for ribbons with large pearl edges had occasioned a sudden extension of the trade, the number of looms in Coventry and the surrounding parishes was 8491; in the year 1838 the number was 13,239, nearly all of which were employed. The real increase in the number is greater than at first sight appears, owing to the larger proportion of engine-looms, which make several pieces at once, to the single-hand. The quantity of silk dyed in 1827 was 339,956 lbs.; in 1837, 451,110 lbs. The fashion, which in 1837 was in favour of gauze ribbons, had exchanged them for a heavier style of goods, and many ribbons were produced in Coventry which equalled in quality their foreign rivals of the same make.* The anxiety to procure French fabrics merely as French has diminished since they became more common. A purchaser asks less often than formerly 'is it French or English?' and if the question be put, it not unfrequently happens that an article is termed either the one or the other to meet the wishes of the customer, so slight is the appreciable difference. Some of the Coventry manufacturers are also importers of French ribbons. Mr. Fletcher states, in his Report on the Handloom Weavers, 'that neither the weavers nor the master manufacturers generally mentioned prohibition as a remedy to which they now laid claim.' The masters demand chiefly better regulations concerning the levying of the duty, which, from the want of a custom-house officer acquainted with the ribbon trade, is done with great inexactness, some goods paying more than, and others scarcely half, the legal amount of duty; and that smuggling should be punished by personal penalty rather than by fine; for as smuggling is now carried on by a few large capitalists, who calculate the risk of fine in the charges, instead of by petty coasting traders, as was the case under the system of total abolition, the punishment by fine affords scarcely any protection. The cost of smuggling in 1830 was reckoned at about 20 per cent.†

Originality is at present very little attempted in patterns; they are in general mere copies of the French or recombinations from them. There are a few artists and superior weavers engaged in preparing them, but their remuneration [illegible] trifling. A drawing-class at the Mechanics' Institute, [illegible]ndon, has had some effect in developing a taste for design among its members; and a School of Design, supported by national funds, has existed for more than two years in London, under the superintendence of government.

The ribbon manufacturers of Coventry are about 130 in number, including about 40 'first-hand journey-hands' who own their looms and work them on their own account. These employ nearly all the hands of the district. The leaders of the trade are not, as formerly, the manufacturers, but the 16 or 18 London and Manchester houses through whom the ribbons are distributed to the retailers. Their buyers attend at Coventry regularly, many of them once a week; according to the demand, they give orders or purchase from the stocks already made. To keep his best hands together the manufacturer is obliged to give out work even when trade is flat; his stock therefore continually accumulates; if of fancy goods, it must be sold whilst fashion favours the demand, or kept at the risk of heavy loss; if of plain goods, they are held with the chance of fluctuation in value as the price of silk rises or falls. A reduction in the price of weaving would depreciate the value of the stock in hand; the manufacturer has therefore so far an interest in keeping up the rate of labour. Formerly the same price was always given for the same labour, so that if from the depression of trade this was too high for the profits, the manufacturer gave out no work at all, but when the old system of trade was changed by the competition of the great warehousemen, and the excess of hands increased, numbers were glad to obtain work on any terms. This led to a general reduction of wages; the larger manufacturers and the weavers struggled ineffectually to maintain an equality of the prices of weaving by voluntary co-operation in the trade, and they attempted in 1818 to procure the extension of the Spitalfields' Act for the regulation of the silk weavers wages by the magistrates, from London and Dublin to Coventry. The evidence however adduced upon this occasion led to the repeal of the act altogether in 1824. Many efforts were subsequently made in Coventry to establish a list of prices to which all should conform, but the competition with France, with steam-power, and the interests of the trade continually caused its infraction, and since 1834 there has been no fixed regulation of prices except in the plain engine-trade.

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* The best ribbons made in France are those prepared for the English market; the home consumption is chiefly of less costly goods.

† The cost of smuggling is now (1840) rated at from 10 to 15 per cent. The proportion of French silk goods smuggled into England to those regularly entered, between the years 1827 and 1839, varies from 36½ per cent. to 56½ per cent. per annum. ('Report of the Select Committee of the Commons on the Import Duties,' August, 1840.) Since the above remarks on French competition were written, this Report has appeared, and is strongly corroborative of them. It must not be forgotten that the impolicy of prohibition shown in one branch of trade applies to all. It is not surprising that, when the manufacturer, upon every successive reduction, represents to the weaver that his wages are lowered because French ribbons are admitted, he should believe that this is the cause of the evil which oppresses him, and that he cannot see why, if he must make cheap ribbons, he may not be permitted to have cheap bread. The winter of 1839-40 was a season of considerable distress at Coventry, from a change of fashion, added to the general depression of the manufacturing interest. The ribbon manufacture of England has sufficient difficulties to encounter in its rivalship with the French, to require the aid of the only *legitimate* protection—an unrestricted interchange of its productions with the necessaries of life in the markets of the world.

The weaving is done on several systems. The *undertaking system* applies now only to the single-hand trade in the country districts,—Bedworth, Nuneaton, Hartshill, &c.: it is the same that the French have employed since the days of Colbert. According to this plan, the undertaker, or master-weaver, receives the silk dyed in the hank from the manufacturer, and returns it in finished ribbons to his order; all the intermediate operations being included in the price of weaving—two-thirds of this are paid to the journey-hand for his labour; three-fourths of the single-hand weavers are women, and nearly one-half of the remainder are youths under 20. Boys and girls are considered competent weavers at 16 or 17.

On the *journey-work system*, by which the great proportion of the engine-looms in Coventry and its neighbourhood are worked, the manufacturer gives the silk, already wound and warped, to the 'first-hand journeyman,' who is also the owner of the looms. The shoot silk is given in hank, for the winding of which the manufacturer allows 1*d.* per oz., besides the price for weaving, in which is included 'the filling,' or the winding of the shoot on the small revolving pins within the shuttles. About one-fourth of the hands employed on this system are women.

On the *hand-factory system* the manufacturer is the owner of the looms. The 'journey-hands' work them in the 'loom-shop' of the proprietor, who gets the winding and warping done at his own charge, leaving only the filling to the weaver, which is included in the price of his work, and is often done by very young children. This plan is adopted by many manufacturers of small capital, who, by personally superintending the work, and becoming in fact their own 'undertakers,' are enabled to economize to the utmost in the cost of production, while their hands are all reduced to the lowest condition of the weaver—the journey-hand, who supplies the labour, and has no property in the looms. A modern innovation, encouraged by the last system, is the employment of two hands to a loom, the one being occupied uninterruptedly in 'shooting down,' or passing the shuttle and making the ribbon; the other in 'picking up,' or fastening broken threads, picking out knots, &c. The perpetual 'shooting down' without the 'picking up,' which relieves the muscles, requires more than ordinary strength; besides which the weaver, being confined to the almost mechanical successive movements of his feet upon the treadles, one hand driving the shuttle, the other striking the shoot with the batten, is reduced from a skilled artisan to the mere moving-power of a machine. The weavers therefore oppose this arrangement, although it is found that in light work a man of average strength, with his wife picking up for him, will get through nearly double the work of a single weaver, and thus save the difference between the value of his own labour and the cheaper labour of his wife.

On the *steam-factory system* the manufacturer gets every preparatory process done; and by the steam-power one half of the weaving process itself—the shooting down: all that is left to the weaver being the picking up and superintendence. The profitable application of steam-power to silk-weaving was long considered to be almost impossible, so large a portion of time being consumed in the handling and trimming of the silk, in proportion to the time that the loom is in motion, and a consequent waste of power. 'I despair,' said one of the Macclesfield manufacturers in 1832, 'of ever applying power-looms to silk.' (*Commons' Committee*, 1832; Qu. 11,494.)

A small factory was built in Coventry in 1831, for the purpose of making the experiment on ribbons. It was burnt however during a disturbance relating to prices; and though the act was disclaimed by the weavers in general, the feeling amongst them was so strong against the employment of *inanimate labour* whilst their own was superabundant, that the scheme was given up. Within a few years there were numerous steam-factories at work at Congleton, Leek, Derby, and other places, which made large quantities of plain ribbons, chiefly black sarsenets. The Coventry manufacturers, alarmed for the interests of their trade, formed, in 1836, a steam company, and erected a large factory, but difficulties arose as to the apportionment of the power among the different parties, and it has never yet been fitted up for its original purpose. Another large factory was soon after built, and applied to the making of figured ribbons, but owing to the failure of the parties, the experiment was not fairly tested; the difficulties must be greater in the case of figured than of plain ribbons, because in them the unskilled labour, which the steam-power supplies, bears less proportion to the value of the article than in any other. One experiment on a smaller scale had some success. The steam factories of the north and of Derby have proved its advantage as applied to plain ribbons. At Congleton there were, in 1838, 254 power-looms engaged in the manufacture of plain black, a few black satin, and some plain coloured ribbons; at Leek there were 100 employed in the same way, and at Derby 233. In these each loom is tended by one pair of hands, which pick up and keep the machinery in order: the gain consists, not in a more rapid motion of the shuttles, the delicacy of the materials not allowing of this, but in the shooting down being seldom interrupted during the picking up, as in hand-loom weaving; in the greater regularity of the fabric, the same number of shoots to the inch being uniformly maintained; and also in the addition of from one-fifth to one-third more shuttles, for which one workman suffices, the loom being so constructed as to enable him to reach from the front over the batten to the warps behind. But when two pair of hands are required for one loom, as is the case with the Jacquard, one before the loom to tend the work, and one behind to pick up, the advantage is much lessened; the only chance of saving will be by the use of the best possible silk in order that few stoppages may occur. The goodness of the silk is plainly of much importance to the success of all steam-loom weaving. It is undoubtedly making great progress notwithstanding all disadvantages; at the present time (1840) the steam-factory at Coventry, which formerly failed, is again at work under the management of fresh parties, who are making both plain and fancy ribbons with a strong probability of ultimate success The fine factory belonging to the Steam Company, which is now occupied by broad silk steam-looms, has one ribbon-loom at work; and in one other instance, in Coventry, Jacquard steam-looms are employed in making light figured ribbons with great precision and beauty, and in this case it is found that one man is able to tend the front and another the back of two looms. There can be little doubt that the time is approaching when steam will be the chief motive-power of the ribbon as of other manufacturing districts, and that the strength of English machinery will be called forth to enter into competition with French taste.

Raw Silk is the silk in its natural state when wound from the cocoon. It varies in fineness according to the number of cocoons reeled off at once to form one thread, the filaments of which are united by their viscid property. In the process of dyeing the gum is discharged more or less, and the fibres become loose and unfit for weaving; the raw silk is therefore manufactured first into *singles*, *tram*, or *organzine*. By *singles* is signified one of the reeled threads twisted. *Tram* (from the French *trame*, or 'shoot') is formed of two or more threads twisted together, and is used in weaving ribbons for the shoot or weft. *Organzine* is formed of two or more singles twisted together in a *contrary* direction from that of its component singles. *Marabout* is silk thrown twice, and is made from fine white silk from which the gum has not been boiled; that of the French is the best. This preparation of the silk is the business of the throwster, a word formed from the word 'throw,' in the obsolete sense of 'to twist, to twine.'

Italian organzine, either thrown in Italy or in England from Italian raw (and principally the last), is used for the warp of the best English ribbons. Bengal and China organzine for inferior qualities. China, Bengal, and Brussa (a Turkish silk, produced at Bursa or Brusa, in Asia Minor) singles, all English thrown, are used largely for shoot. Bengal cannot be used for fine colours. Marabout is used for gauzes.

There are four throwing-mills in the neighbourhood of Coventry, besides several small establishments where hand-machinery is employed, in which the raw silk purchased by the manufacturers is thrown. The silk is bought through the London brokers or the Coventry silkmen, at a credit of five months.

The dyeing is carried on by four houses in Coventry. When the silk is dyed *soft*, that is, when the gum is boiled off, it comes back from the dyer with a loss of four ounces out of sixteen in weight; when dyed *souple*, the gum being partly retained, it loses only one ounce and a half in sixteen. Inferior warp silk dyed black, and of dark colours, is sometimes *weighted*, notwithstanding the proclamation of King Charles, by an additional quantity of dye, or by a mixture of sugar to increase its apparent substance. The French dyeing is considered to possess little or no superiority over that of the English; their blacks are inferior.

The fineness of the silk is determined by the number of warp lengths, measuring seventy-two yards, in the ounce; fine warp silk, for instance, 'runs' about eight score threads to the ounce of that length. One ounce in twenty is allowed for waste in the manufacture of the silk into ribbons; for all over that quantity the undertaker, or journey-hand, is accountable. If the warp and shoot are delivered ready wound, a quarter of an ounce in twenty is allowed. The preparation of the silk by winding it from the hanks on bobbins, and then again winding it off from a sufficient number of these bobbins at once round a large revolving perpendicular reel, called the warping-frame, until the requisite length is obtained for the piece of silk or ribbon that is to be manufactured, and likewise the weaving process itself, are the same for the making of ribbons and for broad silk. The single-hand ribbon-loom differs in no essential respect from that used for any other fabric, except that its size and strength are proportional to the lighter material.

The *Dutch engine-loom* was introduced about seventy years ago. In this loom, instead of one piece of ribbon only, several are woven at once, four of the broadest width, or as many as twenty-four of the narrowest. Each warp has a separate shuttle. The batten extends across the whole width of the loom; the shuttles slide within grooves made in the batten; the driver is worked horizontally backwards and forwards by a handle. At each motion the shuttles are propelled by the cross bars of the driver across their proper warps in the corresponding direction. The loom is worked by the hands, and with treadles for the feet, like the single-hand. The stroke of the batten (from the French *battant*) is made with more precision than in the single-hand loom, by the interposition of blocks of wood fastened to the frame-work in front, which resist the batten at the proper point. The impulse of this stroke pushes back the finished ribbon, which is hung with a weight attached to the end over a pulley at the top of the frame, or wound on a roller, just enough to draw forwards the warp, which is similarly hung over a pulley, in order to receive the shuttle at the same point. Each warp has a separate reed or *sleigh* attached to a horizontal roller, over which it passes on descending from the pulley. The sleigh is an instrument like a comb (called by the French weavers *le peigne*), for keeping the threads separate. There are corresponding sleighs in the batten. The cost of a plain engine-loom for sarsenets is about 8*l*., for satins about 12*l*. The hire of one is about one shilling per week.

Steam-power is applied to the different ribbon-looms by the ordinary methods. Those worked by steam are generally larger than the hand-looms.

The *à-la-bar*, or *bar-loom*, was invented and introduced into St. Etienne by two Swiss brothers about sixty years ago. It has largely contributed to the prosperity of the place, but the brothers died in poverty and neglect. It is a hand power-loom worked by means of a long transverse handle or bar, which extends along the front of the loom, and is connected with wheels on each side, which communicate the motion. The shuttles are driven by means of a rack and pinion across the warps. The advantage of the bar-loom consists in the saving of labour by the intervention of mechanical means, instead of applying the human power direct to the usual operations of weaving. The original cost of these looms is considerable (from 80*l*. to 100*l*.), and they have been little used in Coventry. There are but about eight in the town, with the exception of several which are worked by steam in the factory above mentioned. At Battersea they are employed in weaving figured ribbons. In the bar-looms of St. Etienne from twenty-eight to thirty of the narrowest and from six to eight pieces of the broadest width are made at once: about eight ells of the former per day, and from three to four of the latter.

Several hand power-looms have been contrived and adopted, in all of which the requisite movements are performed by a combination of levers, springs, cranks, and wheels. In a factory at Kettering connected with a Coventry house, six looms are worked by one man by means of a wheel. In all these cases of course separate hands are required to superintend the weaving.

Figures on ribbons, as in other fabrics, are chiefly formed by omitting the regular crossing of the warp and shoot in such a manner that a difference of texture shall occur in the web so as to mark out any pattern. This is effected in the single-hand loom by a multiplication of treadles connected with the lisses by which the different portions of warp are alternately raised. Forty treadles have been sometimes required to form an intricate pattern. Small figures produced in this manner are called *leys*. To execute more complicated patterns, *tires* (from the French word *tirer*, to draw or pull) are used. Tires are cords hung over the top of the loom, and pulled by the hand as the figure may require; they work like the treadles, by raising the lisses, through the eyes of which are passed the threads which are to form the pattern. Small patterns are still largely made in the single-hand looms by means of treadles and tires. The French single-hand loom of this description is called *hautelisse*. This was the name of the loom used in weaving the best tapestry, in which the warp was stretched perpendicularly, and hence it came to be applied to other looms for weaving figures. The hautelisse looms of St. Etienne are now generally worked by a bar, as well as the engine-looms.

The production of a large pattern in the manner above described is difficult and tedious. Many skilful contrivances have been devised by weavers and others for facilitating the operation, and among others the draw-boy; but they were all superseded by the introduction of the Jacquard machine, said by some to have been originally invented by the Chinese; it was brought to England in 1820. By means of this most ingenious invention the lisses are raised in the required order for the formation of the pattern, by an apparatus affixed to the loom, enabling the weaver to produce with nearly the ease and rapidity of plain weaving, patterns which it would formerly have been almost impossible to execute. The 'numbers' (that is, the numbers of the needles which regulate the raising of the warp threads) of some of the machines at St. Etienne are as high as 1050, those of Coventry range from 250 to 600. The price of a Jacquard engine-loom for sarsenet figures is from 16*l*. to 20*l*., for satin figures from 20*l*. to 24*l*. The hire of one is 1*s*. 6*d*., and sometimes 2*s*. per week. The number of Jacquard machines in Coventry and the surrounding district in 1838 was 2228. The draughting of the patterns and stamping of the perforated cards is a separate business, which is done on the premises of the larger manufacturers. The Jacquard is capable of being applied to both the engine and single-hand looms, but as the same cards and machinery are required for one breadth in the single-hand, as for several breadths in the engine-loom, it is seldom attached to the former except for a few very rich goods.

The work is ordinarily given out in *sets of grosses*, consisting of two warps for each shuttle, each warp containing two pieces of 36 yards. The ribbons are cut out in pieces of 36 yards if they are of satin, and in half pieces of 18 yards if they are sarsenets or gauzes above the narrower widths. A set of pieces cut out of a loom is called a *length*, and a set of half pieces a *half-length*. The putting in of a fresh set of warps is a tedious operation, which requires from two or three to fourteen days, and proportionally lessens the earnings of the weaver. In the Jacquard loom two weeks out of six are lost in this preparation of the work, besides the delay which he frequently experiences in getting the fresh silk from the manufacturer. A simple change of pattern is often effected with very little loss of time. Whenever it is practicable, the ends of the new warp are fastened to those of the old before it is taken out of the loom, whereby the labour of passing them separately through the eyes or mails of the lisses is saved: this is called *twisting-in*. To *mount* a Jacquard loom, or prepare it for weaving, requires perhaps a month or more, but a change of pattern is often affected with very little loss of time.

Ribbons are made according to a fixed standard of widths designated by different numbers of pence, which once no doubt denoted the price of the article, but at present have reference only to its breadth. The French distinguish their widths by simple numbers.

All dressed ribbons, as satins, gauzes, &c., are made in the loom one-twelfth of an inch wider than sarsenets, in order to allow for the diminution of breadth which results from the lengthwise stretching which they receive in the operation of dressing. Fine gauzes require an allowance of two-twelfths.

Standard width in inches.	¼	7/16		5/8	10/12		1 1/12	1	1 7/12	1 10/12	2 1/12		2 7/12	3 1/12			3 10/12		4 7/12			
English numbers	1*dy*	2*dy*		4*dy*	6*dy*		8*dy*	10*dy*	12*dy*	14*dy*	16*dy*		20*dy*	24*dy*			30*dy*		40*dy*			
French ditto .	½ ¾ 1	1¼	1½	2	3	4	5	6	7	8	9	10	12	14	16	18	20	22	24	30	40	50	60

The French ribbons were made formerly in pieces of 12 ells; their length is now the same as that of the English. French fancy ribbons are generally made and sold in *garnitures*, that is, a broad and narrow piece taken together of the same pattern.

Sarsenet and lutestring ribbons are made by the simple and regular alteration of the warp and shoot, as in plain cloth, called technically *ground*. Lutestrings are sarsenets above the width of 12*d.*, and in general of stouter make. Several threads of the warp pass through each *dent* or *tooth* of the sleigh, according to the fineness of the silk or intended quality of the ribbon. In a lutestring the dents are in the proportion of about 40 to the inch—the shoots about 90, varying with the quality. By *grogram* (French *gros-grains*) is meant a variation in the texture, caused by the warp-threads passing over two of the shoots at once, taking up one only: this often finishes the edge of a ribbon.

Organzine dyed *soft* is used for the warps of all ribbons except gauzes, from its greater strength and compactness of fibre; tram and singles dyed *souple* for the shoot of sarsenets and sometimes of satin.

In *satin* the glossy appearance is given by the threads of the warp being laid chiefly on the surface, each thread of the warp being crossed by the shoot only once in five times, as in 5-lisse satin, or once in eight times, as in 8·lisse or the superior satins. French satins were formerly made from 6-lisse to 10-lisse. Satins are woven with the face downwards, as it is easier to raise the harness connected with ⅕ or ⅛ of the warp each time that the shuttle passes than to raise ⅘ or ⅞. The number of dents and shoots to the inch are nearly the same for satin as for lutestring. The threads between each dent are generally put in in odd numbers, 9, 11, 13, which are supposed to fall in better, and produce a better surface. The French satins are lighter in make than the English, but they have a peculiar richness and lustre, owing to their superior silk. French ribbons in general have less weight of silk than the English.

The transparency of *gauze* is produced by the kind of silk of which it is made—the fine hard-twisted marabout, which leaves the interstices clear. One warp thread only passes between each dent of the sleigh, and these are closer together in general than lutestrings and satins. In fine gauzes 80 or more dents, and from 90 to 120 shoots to the inch. The plain gauze ribbons made at Coventry called China gauzes are chiefly those used for mourning—white, black, and lavender, with satin or ground stripes.

Floret Gauzes and Taffeties are light ribbons made of organzine warp shot with hard or marabout silk. There is considerably less labour in these than in other gauzes; they are largely manufactured at Bedworth.

Loves are inferior gauzes made of organzine, and singles dyed *hard*, or upon the gum.

Petershams or *Pads* (derived perhaps from the French *padou*, a coarse ribbon used by tailors, made of linen and silk, often stiffened by gum), are stout thick ribbons used for the waist.

The sleighs employed for making plain ribbons (*taffetas*) in France, have about 51 dents to the inch, for satin 54, for gauze 72-78-84, for velvet 36-42.

These ribbons all belong to the plain trade. The fancy trade comprises the manufacture of the same fabrics figured, under the heads of figured sarsenets, satins, gauzes, and pads.

The figures are frequently produced in a different colour from the ground by the mixture of colours in the warp; the colours being warped separately. In the intervals of the figures the coloured threads are carried along the under side of the ribbon; it is said to have a double or treble figure, according to the number of colours passing through each dent. In some ribbons, gauzes in particular, these threads are cut away by the scissors after the ribbon is made. This is called clipping. A change of colour in the shoot is effected by the use of different shuttles; in brocades the figure is made by small additional shuttles, thrown in partially across the ribbon as the pattern may require; the connecting threads of shoot being clipped off. By damask is meant the laying of the warp over the shoot to form the figure in the manner of satin. The patterns are sometimes geometrical, but more frequently combinations of leaves, sprigs, or flowers. In the superior French ribbons groups and wreaths of flowers are executed with the richness and variety of hand-embroidery. The French are continually introducing novelties in colouring and in texture. In one of recent appearance the ribbon is laid over with a slight covering like crape, by means of a warp of hard-silk woven in loosely over the other: in another the ribbon is made by stamping to assume the appearance of lace.

Some fancy ribbons are of plain texture but varied in colouring; they are shot or woven in shades, stripes, bars, or cheques, called in the trade *plaids*; these last, which require the shuttle to be changed very frequently, are still made in the single-hand loom. In shot ribbons the warp and the shoot are of different colours. A pearl-edge is frequently given to all kinds of ribbon except the narrower widths of sarsenet. This is formed by the shoot passing over horsehairs placed outside the warp parallel with it, and raised in like manner by the lisses; as the hairs are drawn out, the silk is left in loops at the edge. Many varieties of ornamental edges, as scollops, fringes, &c., are produced by *drawing in*. The shoot in this case stops short of the edge of the ribbon, catching in an additional thread of silk, sometimes of a different colour, which it draws in in its place, and which is delivered from a bobbin at the back of the loom, and is in a manner darned into the ground of the ribbon.

Clouding is a peculiar management in the dyeing, by which a change of hue is produced in the same thread of silk. The silk, already warped, is tied up and wound closely round with packthread at regular intervals of more or less than an inch, so that the intermediate spaces only are penetrated by the dye.

In one species of fancy ribbon, called *Chiné*, the figures are printed or painted on the warp after it is prepared for the loom, and afterwards woven in by the shuttle; others are embossed after the mode of the Parisian Chandelier.

Ribbons are watered by passing two pieces together between two cylinders, one of which has a heater within it. The irregular pressure of the inequalities of the two surfaces of silk against each other produces a wavy appearance.

Satins are soft and flossy when taken out of the loom; to smooth and stiffen them, they are calendered, or pressed between heated steel cylinders, and afterwards dressed, or passed over a small cylinder covered with flannel, which is moistened with a size made from buffalo hides, and then over a large one of heated steel. Gauzes also are dressed, and sometimes even lutestrings. The French goods are in general better dressed than the English.

The *blocking* of the finished ribbons, or the winding them on cylindrical pieces of wood, is generally done at the warehouse of the manufacturer.

Galloons and *doubles* are strong thick ribbons, principally black, used for bindings, shoe-strings, &c. The narrow widths are called galloons; the broader, doubles. Italian silk is used in making the best qualities only, Bengal for the commoner. They are manufactured at Spitalfields, at Reading, in Devonshire, in the power-looms of Manchester, at Derby, and other places. There is a considerable exportation of these goods, as there is likewise of the produce of the steam ribbon-looms.

Ferrets are coarse narrow ribbons shot with cotton, used for similar purposes.

Ribbon velvets are manufactured in Spitalfields and at St. Etienne: they are also made at Crefeld in Rhenish Prussia, which has long been a principal seat of the velvet manufacture. The following were the prices paid in 1832, by a principal firm of that place, for the weaving of ribbon velvets:—

		s.	d.	
No. 12	8 pieces in one loom	1	1	for 36 yards.
24	6 ,,	1	7½	,,
30	6 ,,	1	9½	,,
50	5 ,,	2	3	,,
100	3 ,,	4	3	,,
150	3 ,,	6	9	,,

One man makes thirty-six yards in two weeks on an average. The ribbon-weavers live in the country, and those who make the narrow numbers are miserably poor, though they make 288 yards in a fortnight. Italian silk only is used. (*Commons' Committee*, 1832.)

In *gold* and *silver* ribbons a silk thread of similar colour is wound round by a flattened wire of the metal, and afterwards woven. Lyon was particularly celebrated for its fabrics of this kind.

The following table and lists are extracted from the valuable Report of J. Fletcher, Esq., on the Hand-loom Weavers, from which very considerable assistance has been derived in the details of the Coventry trade.

Approximate Statement of Coventry Weavers' Earnings when in full work, at different periods.

Artisans earning the Wages below stated	1793	1806	1813	1818	1823	1831	1838	Observations.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	
Undertakers in the single-hand trade, supposing each to have on the average 7 looms, and to receive from each one-half a journeyman's wages	about 15 9	about 15 9	35 0	19 3	19 3	19 3	18 6	The proportion of deduction for fire and light, to which the earnings of the journey hands have been subjected, multiplied, allows for the current shop expenses of the undertaker; and his apprentice looms compensate for any deficiency of profit out of looms worked by women.
Journeymen weavers in the single-hand trade	probably 4 6	probably 4 6	10 0	5 6	5 6	5 6	5 0	These earnings are the groundwork of the preceding statement.
Half-pay apprentices in the single-hand trade	about 3 0	about 3 0	about 7 6	about 4 0	about [illegible] 0	about 4 0	about 3 9	Half of the warehouse prices paid to these learners is one fourth less than the journey-hand pay, which is two thirds.
'First hand journeymen' in the plain engine-loom, owning their looms, as they now commonly do, after deducting every expense, but without making any deduction for loom-hire since the commencement of the journey-work system	..	..	..	..	..	11 10	11 6	These earnings doubled, for the 2 looms which are on the average worked by each family, ought properly, in estimating the journeyman's condition, to supersede those placed next below them, since they would then contain the profit which the journeyman of late years derives from being proprietor of his own looms, with the addition of rent paid him for other looms; and therefore show his present income, as compared with the prices below, which show his former income.
Journeymen weavers in the plain engine-loom (deducting loom-rent since they have been owners of their looms, as being profit, and not wages)	8s. to 12s.	17 0	20 0	10 0	17 0	10 10	10 6	These earnings, and those of the single-hand journeymen, are the proper comparative tests as to the price of mere labour, in contrasting one period with another, and looking at prices generally
'Journeymen's journeymen' in the plain engine loom, in the same position under the 'first-hand' journeymen that the latter formerly held under an undertaker, and consequently the first that are thrown out of work at a slack time	..	..	..	..	..	9 10	9 6	These are the earnings of a class approaching in position the journey-hands under the undertakers in the single hand trade, and, like them, among the first thrown out of work at a slack time
'First hand journeymen' in the Jacquard engine loom, owning their looms, as in the plain engine-trade	..	..	..	..	..	16 6	15 6	These earnings properly take the place of those formerly obtained in the plain engine loom, in a comparison of earnings at successive periods; the plain engine loom being formerly as much the sole superior class of work over the single-hand loom, as this is now over the plain engine-loom.
Journeymen weavers in the Jacquard engine loom (deducting a loom rent, which they have to pay when not proprietors of their looms)	..	..	..	..	..	15 9	14 0	These figures are inserted to compare with previous *mere wages* in the plain engine-loom, which are hence seen to have declined from their money rate in the steady times of trade of 1806 and 1823, although the money *income* of the workman differs much less.
'Journeymen's journeymen' in the Jacquard looms, if at two thirds pay	..	..	..	..	..	..	about 10 6	These are the hands first thrown out of work at a slack time.
Factory journeymen in the Jacquard engine-loom, in the highest paying factories	..	..	..	..	..	.	12 0	The difficulty of obtaining approximate estimates of these, and of all earnings in the figure-branch, is exceedingly great.
Factory journeymen in the Jacquard engine-loom in the Bedworth and in the Coventry lower-paying factories	..	..	..	..	..	..	9s. to 12s.	
Factory journeymen in the Jacquard engine-loom in the Nuneaton factories.	..	..	..	..	..	..	8s. to 9s.	
Half-pay apprentices in the engine trade	..	..	..	..	..	..	say 5s 6d.	These are chiefly in the figure-trade.
Winders (women and children)	..	..	..	..	..	..	5s to 11s	Averaging 7s. or 6s. 6d.
Warpers (chiefly women and children)	..	..	..	..	..	..	8s. to 12s.	Averaging 10s.

Coventry Plain Engine List of 1835, *by which the Trade is still governed.**

Description of Work.	Width of Work.	Per Piece. s.	d.	Description of Work.	Width of Work.	Per Piece. s.	d.
Plain Sarsenets	1	0	6	Satins (8-lisse)	1	0	10
..	2	0	7	..	2	1	0
..	4	0	9	..	4	1	3
..	6	1	0	..	6	1	[illegible]
..	8	1	3	..	8	1	11
..	10	1	6	..	12	2	6
..	12	1	10	..	16	3	[illegible]

Description of Work.	Width of Work.	Per Piece. s.	d.	Description of Work.	Width of Work.	Per Piece. s.	d.
..	14	2	1	..	20	3	6
..	16	2	4				
..	20	3	0				
..	24	3	3				
Loves and Satins (5-lisse)	1	0	8	Satin Loves (8-lisse)	.	0	9
	2	0	10		2	0	11
..	4	1	1	..	4	1	2
..	6	1	3	..	6	1	4
..	8	1	7	..	8	1	8
..	10	1	10	..	10	2	0
..	12	2	3	..	12	2	5
..	14	2	8	..	14	2	10
..	16	2	10	..	16	3	0
..	20	3	6	..	20	3	8

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* The late and continued (1840) depression of trade has caused great departure from this list; a considerable reduction has been made in the price of weaving [illegible]; [illegible] it amounts to 20 per cent. It is feared at Coventry that the increasing preference for French satins will extinguish this branch of the trade.

Shading 6*d.* per gross extra. 5-lisse satins are now seldom made in Coventry. The list of prices refers to the width of the ribbons, not to the quality. The labour is nearly the same for the richer as for the inferior goods, the difference consisting principally in the silk of which they are made. Cheap ribbons are generally made by reducing the warp silk, which is the most expensive, and making up the bulk of the ribbon with a larger proportion of the cheaper shoot. When extra labour is required, it is paid for extra. The average cost of the labour of all the processes of weaving is about 25 per cent. of the price of the goods; in gauzes and figured articles the proportion is higher.

List Price of Power-Engine-Loom-Weaving of plain Sarsenet Ribbons at Derby, 1838.

Widths.	Shuttles in each Loom.	Prices Per Length. s.	d.	Lengths made per week.
2	30 (and 36)	10	10	1½
4	28 (24, 26, and 30)	12	6	1½
6	24 (22 and 26)	14	0	1½
8	24 (20 and 22)	18	0	1½*
10	18 (20)	16	6	1
12	16 (18)	17	6	1
14	16 (18)	18	2	1
16	12 (14, 16, 20)	18	6	1
18	12 (14 and 16)	20	4	1
20	12 (8)	22	6	1
24	10 (8)	22	6	1
30	8	24	0	1

It is the universal custom to pay for weaving by the piece; in one instance only, that of the steam-factory, the men receive weekly wages. The *truck* system is unknown, all payments being made in money. It appears that the money amount of the earnings of the ribbon-weavers is not less than it was nearly fifty years ago. The purchasing power of their wages is however greater, and there has been an increase in their domestic comforts, although not in the same ratio as in those of other classes, for in common with the rest of the hand-loom weavers their condition is depressed below that of other artisans. They are less given than formerly to out-of-door amusements and robust exercises, and they have degenerated in physical constitution. Marriages are made much earlier; anxiety of mind produced by family cares in the midst of a fluctuating employment, confinement to the loom, and, among the lower and reckless, the enjoyments of the public-house and gin-shop, induce a great susceptibility to lingering and nervous disorders: they are less liable to acute diseases. Insanity is frequent among them. This inferiority of physical strength presents an obstacle to a change of occupation in bad times, no less than the long exclusive apprenticeship of seven years, the evil of which is peculiarly manifest in this uncertain trade. A want of domestic economy and management results from the employment of women in the trade from their earliest years, but the city weavers, generally speaking, are moral, industrious, attached to their homes and families, and many of them highly intelligent. The condition of the rural weaving population is far worse, and is one of great depression, rudeness, and ignorance.

The number of persons employed in ribbon-making in Coventry, including winders and warpers, was estimated, in 1838, at 6000 or 7000; and in the rural parishes, at 10,000 or 11,000.

RIBBLE, River. [LANCASHIRE.]

RIBCHESTER. [LANCASHIRE.]

RIBE. [JUTLAND.]

RIBEAUVILLE. [RHIN, HAUT.]

RIBE'RA, JOSE', an eminent Spanish painter, better known by the surname of 'Spagnoletto' (the little Spaniard), which the Italians gave him, was born on the 8th of January, 1588, at San Felipe de Xativa, a large town in Spain, about ten miles from Valencia. Having from his early youth shown a great inclination for painting, his parents, though in indigent circumstances, did everything in their power to promote his taste for that art. He was placed as a student under Francisco Ribalta, one of the best painters of the Valencian school, under whom he studied a few years; but before he was sixteen he left his master, and determined to visit Italy. After spending some time at Rome, where he almost lived upon charity, he arrived at Naples in 1606. Here he met with Michael Angelo Caravaggio, whose striking and vigorous style made such an impression upon him, that he never rested until he became his pupil. Under this great master, Ribera made such progress, and his productions were so much admired, that he was considered an accomplished master at the age of twenty. From Naples Ribera went to Parma, where the works of Correggio were then the object of public admiration, and afterwards he visited Rome. Whilst there he attempted to improve his style by imitating the works of Raffaello, but without much success. This circumstance, as well as the great number of excellent artists practising in that city, induced him to return to Naples, where his prospects of employment were greater, that country being then under the dominion of his countrymen the Spaniards. [NAPLES.] After a few months' residence in that capital, the count of Monterrey, the Spanish viceroy, took him under his protection, and employed him in executing considerable works for the king of Spain. In 1630 he was elected a member of the Academy of St. Luke at Rome, and made a knight of the order of Christ by the pope in 1644. Ribera died at Naples in 1656, in the seventieth year of his age. Like his master, his style was characterised by broad lights and shades. His genius naturally inclined him to gloomy or horrible subjects, which he selected both from sacred and profane history. He delighted in designing old men emaciated by mortification, such as hermits and saints, and seems to have at all times rejoiced in the picturesque display of bone, veins, and tendons. In tragic compositions, martyrdoms, executions, and torments, he was eminently successful, and he treated these appalling subjects with a correctness of design and a fidelity which might serve as a study for the anatomist. Thus the spasms of Ixion, St. Bartholomew under the butcher's knife, the torments of Sisyphus, Tantalus, and Prometheus, Laocoon and his sons attacked by serpents, were his favourite subjects. His principal pictures are in the Royal Museum at Madrid, in the Escurial, and at Naples, in which last place he painted the Martyrdom of S. Januarius, for the royal chapel; St. Jerome and S. Bruno, for the church of the Trinity; and the Taking Down from the Cross, for the Carthusians. Ribera sometimes indulged himself in engraving, and he also made six-and-twenty etchings, which were executed in a bold and free style, and with great correctness of design.

(Cean Bermudez, *Diccionario Historico de los Pintores Españoles*, Mad., 1800, vol. iv., p. 184.)

RIBES (a name formerly given to a species of rheum), is a genus of plants forming the natural order Grossulaceæ. As this genus is the only one in the order, its characters, geographical range, and affinities are described with the order. It is well-known as producing the currant and gooseberry, and also for affording many of the ornamental shrubs of our gardens.

De Candolle divides the genus Ribes into four sections, of which the following is an analysis:—

Shrubs with prickles:—	
Peduncles 1-2-3-flowered.	GROSSULARIA.
Peduncles many flowered.	BOTRYCARPUM.
Shrubs without prickles:—	
Calyx campanulate . .	RIBESIA.
Calyx tubular	SYMPHOCALYX.

* GROSSULARIA.

This section includes some handsome shrubs, as well as the species which produces the common gooseberry. Of these we shall notice a few that are most commonly found cultivated in this country.

R. Oxycanthoides, Hawthorn-leaved Gooseberry. Prickles infra-axillary, solitary. Leaves glabrous, lobes dentate. Peduncles short, bearing 1-2 greenish white flowers. It is a native of rocky districts in Canada, and bears a fruit very much resembling that of the common gooseberry both in appearance and taste. Like many other described species of large genera, it has been supposed to be referrible to a more common form, the *R. grossularia.*

R. niveum, Snowy-flowered Gooseberry. Prickles solitary, in pairs or threes. Leaves glabrous, roundish, entire at the base. Flowers two together in peduncles. Sepals reflexed. Stamens longer than the style. It grows to the height of 4 or 5 feet. It was found on the north-west coast of America by Mr. Douglas, who sent the seeds to England in 1826. The fruit is about the size of the black currant, of a deep red-purple colour. It is said to be of a superior flavour to the common gooseberry. 'It has a rich subacid rather perfumed flavour, which is extremely agreeable. The fruit is rather too acid to be eaten raw; but when ripe it makes delicious tarts, and would probably afford an excellent means of improving the common gooseberry by hybridising.' (Lindley, *Bot. Reg.*, Aug., 1834.) The white flowers give it a handsome appearance when it blossoms, making it a valuable addition to our ornamental shrubs.

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* Sometimes less.

R. Cynosbati, Dog-bramble Gooseberry. Infra-axillary prickles 1-2. Leaves 3-4, lobed, pubescent. Calyx campanulate, cylindrical. Petals shorter than stigma and stamens. Berry prickly. This plant is found in Canada, according to Pursh, and was discovered in India by Royle, and in Japan by Thunberg. It differs little from another well-known species, *R. divaricatum*, which has the tube of the corolla somewhat narrower and the stamens longer. Two varieties of this plant are recorded: one with smooth fruit, a native of Hudson's Bay; the other with prickly branches and fruit, shorter peduncles, pubescent purplish flowers, from Lake Huron.

R. grossularia, Common Gooseberry. This plant is too well known to require any description here, and is probably the parent of many of the other recorded species of Ribes. It is found wild in almost every part of England and Scotland, growing on old walls, in hedges and woods, although a question might be raised as to its being aboriginal in this island. It seems to be truly indigenous in France, Germany, and Switzerland; and, according to Dr. Royle, is found in the Himalaya and on the banks of the Ganges. It has also been seen growing in North America, on rocks near the Falls of Niagara.

This plant does not appear to have been known to the antients; and the earliest author who mentions it is Matthiolus, an Italian botanist. It was recorded as existing in England by Turner, Parkinson, and Gerard; but Ray is the earliest writer who mentions it as a cultivated species. The Dutch were the first to cultivate the gooseberry successfully, but even up to the time of Miller it seems to have gained very little repute in England as a fruit for the table. From its extensive cultivation, it has received a great variety of names. In Cheshire and the north of England it is called *Feaberry*, in Norfolk *Feabes*, both of which names are corruptions of Fever-berry, as, according to Gerard, it was at one time considered a specific against fevers. *Grozzer* is a common name for it in Scotland, which seems to be derived from the French name *Groseille à Macquereau*, which is again derived from the Latin Grossularia, and the use of the fruit as a sauce with mackerel. Its common name, *gooseberry*, is derived from gorse-berry, because its prickles resembled those of the furze or gorse. Some derive this name from its berries being used as sauce for geese. [GOOSEBERRY.]

There are numerous varieties of this plant recorded, which chiefly vary in the extent, size, and number of their prickles, and in the shape and size of their fruit and flowers.

R. speciosum, Showy Gooseberry. Shrub prickly, infra-axillary prickles 3. Branches hurspid. Leaves glabrous, on short petioles, 3-lobed. Peduncles with 1-3 deep red flowers, longer than leaves. Stamens 4. Filaments and style red. This plant was found by Mr. Menzies on the western coast of California. Since its introduction into this country it has been a great deal cultivated on account of its beautiful crimson flowers. In its cultivation it requires some care, as the branches are so much reclined, that unless carried up against rock-work or a wall, the flowers will not be well seen. *R. Menziesii* seems to be only a variety of this species.

** BOTRYCARPUM.

This section includes four species intermediate between gooseberries and currants: they are however called by the former name. *R. orientale*, Eastern Gooseberry, with yellow green flowers, blowing in April and May. It is a native of Syria. *R. saxatile*, Rock Gooseberry, a native of Siberia, with greenish-purple flowers.

R. diacantha, Twin-prickled Gooseberry. It flowers in May and June, having yellowish flowers and cuneated leaves. It grows wild in Dauria and other parts of Siberia. *R. lacustris*, Lake-gooseberry, a native of moist places in Canada and Virginia, with flowers like a currant and prickles like a gooseberry.

*** RIBESIA.

This section includes the greater number of the currants, of which there are about forty species. The most common and useful of these is the *R. rubrum*, Common red currant. The name currant seems to be derived from the similarity of the fruit to the Corinth raisin, or small grape of Zante, which are commonly called Corinth's, or currants. This last is too well known to need a description. It is a native of Europe and Siberia, and the northern parts of North America, to the mouth of the M'Kenzie, and is found in mountainous districts in the north of England and Scotland. Like most plants that are easily disseminated and occupy varied elevation, latitude, and soil, this species is subject to many varieties. Of these seven have been recorded by De Candolle, which vary in the shape, size, and covering of their leaves, as well as the size and colour of their fruit. The writer of the article 'Ribes' in Loudon's *Arboretum et Fruticetum Britannicum*, observes, 'the common red currant is commonly treated by botanists as a distinct species, but we have no doubt whatever that *R. petræum*, *R. spicatum*, *R. alpinum*, *R. prostratum*, and several other botanical species are essentially one and the same thing. We have arrived at this conclusion from the study of the plants in the very excellent collections of this genus which are in the garden of the Horticultural Society of London and in the arboretum of the Messrs. Loddiges.'

The currant is not mentioned by Greek and Roman writers, but it is scarcely possible that its beautiful red and sweet berries should have been neglected by the people amongst whom they grew. In France they were cultivated long before the gooseberry, but were first produced in perfection by the Dutch. Gerard mentions that they were cultivated in gardens in his time. Till a recent period very few varieties were known, but several have been lately introduced, especially by the exertions of the late Andrew Knight, Esq. The following is a list of the principal varieties from Don's Miller's 'Dictionary:'—

Red Currants.

1. *Common red, groseiller rouge à petit fruit, groseiller ordinaire à fruit rouge.*
2. *Red Dutch, large red Dutch, new red Dutch, large red, large branched red, Morgan's red, red grape, groseiller rouge à gros fruit.*
3. *Knight's large red.*
4. *Knight's sweet red currant.*
5. *Knight's early red currant.*
6. *Champagne, groseiller à fruit couleur de chair.*
7. *Striped-leaved currrant and variegated-leaved currant.*
8. *Large pale-red Dutch.*

White Currants.

1. *Common white currant, groseiller à fruit blanc.*
2. *White Dutch currant, new white Dutch, Morgan's white, white crystal, white Leghorn, pearl white.*
3. *Pearl white, blanc perle.*
4. *Spearey's white.*

Of these varieties those numbered 2 and 8 among the red, and that 2 of the white, are the best.

The fruit of the various species of Ribes has been used in medicine to allay thirst, and it is said to lessen the secretion of bile. The juice of the red currant is sometimes employed in making punch, and mixed with water forms the *eau de groseilles* of the French. It is also made into a jelly, and the berries are used for making tarts and puddings. When ripe the fruit makes an excellent wine, which is much used in the rural districts of England.

Cultivation.—All the sorts are hardy plants, growing freely and bearing a plentiful crop of fruit. They thrive almost as well in one situation as another, whether it be open or shady, free or confined. This permits of the ripening of the fruit throughout a long period, so that it may be obtained as early as June and as late as October. Common garden soil is suited to them, which should be tilled and recruited from time to time with fresh manure. The largest crops are produced in a strong loam or improved clay-soil. They are earlier in a light soil. Previous to planting, the soil should be dug two feet deep, and this may be done at any time from October to February or March. They are chiefly propagated by cuttings obtained early in the spring. These should consist of the previous year's shoots taken from bearing-branches, and be from ten inches to a foot in length. They should be planted 4 or 5 inches deep and may be watered in spring. In the summer all the shoots or buds should be removed except three. In the following autumn they may be transplanted. Currant bushes are best planted by themselves, and the distance between the rows should not be less than from 7 to 9 feet. They will grow freely against a wall, and when thus planted with a south or south-west aspect will produce ripe fruit three weeks earlier than standards with a north or north-east aspect: fruit may be preserved good till October, and if matted, as late as November. Grown on espalier rails the fruit is produced in the finest order.

The fruit of the currant should be gathered in dry weather, as when gathered in rain it loses its flavour.

R. nigrum, Black Currant. Flowers whitish or yellowish green. Calyx a rich brownish red or pink colour. The stamens and petals frequently present a remarkable peculiarity: the usual number of each is five; but should either the petals or stamens be increased in number, the other is diminished; thus if there are seven stamens, there will be but three petals, and if there are ten stamens, there will be no petals, and *vice versâ*. The peculiar strong smell of the leaves of this plant is very characteristic. The black currant has the same geographical range as the red, but is found more abundantly in the north than in the south of Europe. It is now common in Great Britain, but is probably not indigenous. It is found in Siberia, on the Caucasus, and in Sweden. It is indigenous in the woods of Russia as far as St. Petersburg, and in this district the fruit is found green, yellow, or even white. Species of Ribes are also found in India and South America with black fruit. There are three wild varieties: *R. bacca flavida*, with a dingy greenish-yellow fruit, supposed to be a hybrid between black and white currant; *R. bacca virida*, with green fruit; *R. foliis variegatis*, with leaves streaked with yellow. The principal garden varieties are

1. *Wild black.*
2. *Black grape, Ogden's black grape.*
3. *Black Naples, Cassis* of the French.
4. *Green-fruited black.*
5. *Russia green.*

Of these, that numbered 3 is decidedly the best for use.

The fruit of the black currant is not in so great repute as the red, and is of comparatively modern introduction. Gerard mentions it, and says that its berries are of a stinking and somewhat loathsome flavour. It is often used as a medicine. The leaves and fruit are diuretic, and are employed in the composition of the Siberian *quass*. An intoxicating spirit is distilled from the berries, and they are also used for colouring various kinds of spirits in Siberia. As a popular remedy for sore throat, they are much employed for making jelly, especially in Russia and Scotland. The leaves are frequently used by the poor to mix with black tea in order to give it the flavour of green.

R. sanguineum, Bloody or Red-flowered Currant. Leaves cordate, serrated, villous beneath. Racemes drooping, twice the length of leaves. Calyx with spreading segments. This is the most ornamental species of the genus, bearing large racemes of deep rose-coloured flowers, which are followed by berries of a bluish-black. It is a native of the north-west coast of America. This as well as the other species of currants may be propagated in the manner described for the red currant. As this plant has been extensively cultivated, a great many varieties are to be found.

R. atropurpureum, Dark Purple-flowered Currant. Stem erect. Leaves pubescent. Racemes drooping. Calyx ciliated. Berries dark purple, glabrous. It is a beautiful shrub, a native of the Altai and mountainous districts on the river Ural, but it has not yet been introduced into this country.

**** SYMPHOCALYX.

The species of this section are cultivated entirely as ornamental shrubs.

R. aureum, Golden-flowered Currant. Petiole glabrous. Leaves 3-lobed, shorter than the petioles. Calyces longer than pedicels. Petals linear, shorter than calyx. Flowers golden-yellow. Fruit yellow, and of an agreeable flavour. It is a native of the north-west of America. Of this plant there are varieties, *R. præcox*, *R. villosum*, and *R. serotinum*. They are all beautiful shrubs, and deserve a place in every collection. Of the remaining species, *R. tenuiflorum* and *R. flavum* are well worthy of cultivation.

RIBGRASS. [PLANTAGINACEÆ.]

RICARDO, DAVID, to whom the science of political economy is perhaps more indebted than to any other man of our own day, was born in London on the 19th April, 1772. His father, a native of Holland, had then been for several years a member of the Stock Exchange in London; and designing his third son, David, for the same occupation, gave him a good but plain commercial education. For this purpose he was sent, when eleven years of age, to a school in Holland, where he remained for about two years. Soon after his return to England he was taken into his father's office as a clerk, and, when of age, was associated with him in business. In 1793 he formed a matrimonial alliance displeasing to his father, by reason of his religious scruples, the elder Mr. Ricardo having been born of Jewish parents, and continuing to profess their faith until his death. This breach between the father and son, which was afterwards entirely healed, necessarily caused their separation as regarded business, and threw the subject of this notice altogether upon his own efforts, seconded however, in a manner highly honourable to all parties, by many of the leading members of the Stock Exchange. Mr. Ricardo continued to be a member of the Stock Exchange until 1818, and was eminently successful, taking for many years a leading part in its business, and realising a princely fortune by conduct which gained for him universal respect.

During the years in which Mr. Ricardo was most actively engaged in business, he continued to devote much time to study and to scientific pursuits. He was one of the original promoters of the Geological Society of London, and for some years a member of its council: he also acquired a considerable knowledge of chemistry, as well as an acquaintance with mathematics. Of late years, the powers of his mind were almost wholly devoted to the elucidation of questions connected with political economy, a study which was at once best suited to the peculiar quality of his mind and most in unison with his daily pursuits in business, and by his attainments in which he was enabled to take his place among the deepest and most original thinkers of his day.

In the beginning of 1819, Mr. Ricardo was returned to parliament by the Irish borough of Portarlington, which place he continued to represent until his death.

The reputation which Mr. Ricardo had previously acquired by his writings ensured to him the attention of the House on all occasions when he spoke, and not unfrequently induced the members present to call upon him for his opinion when the subject-matter of the debate was such as might receive light from his extensive knowledge. Although he confined himself in his parliamentary speeches almost entirely to subjects of finance, and such as fell strictly within the line of economical science, his reported speeches are numerous; and although, from the nature of the subjects which he handled, and with which the newspaper reporters could not be familiarly acquainted, it could hardly be expected that justice could be done to his reasonings, these reports yet furnish a full justification of the desire so constantly evinced by the House, and ample reason for the respectful attention which he always experienced. During each of the five sessions in which he sat in parliament, his name constantly appears as a speaker; and in the latest two years of the series (1822 and 1823) his addresses were very frequent. Although his voice was not good, and his utterance was rapid, it was yet so distinct, that he could be heard without an effort by every member present. His manner was wholly unpretending, and his argumentative style was unrelieved by any oratorical effort; he endeavoured to convince by reason, and to influence only by truth and justice. Those persons who had most narrowly watched the progress of his public career, felt justified in predicting for him a future of the highest usefulness; and had his life been spared, it is reasonable to think that their predictions would have been fulfilled. At the close of the session of 1823, he retired to his estate of Gatcomb Park in Gloucestershire, and, after a very few days' illness, died on the 11th September, of an inflammation of the brain, in the fifty-second year of his age. In private life, Mr. Ricardo was extremely amiable; his temper was mild and equable, and he enjoyed in the highest degree the respect and affection of every member of his family.

Mr. Ricardo first appeared as an author during the discussions that led to and accompanied the famous Bullion Committee in 1810. His pamphlet, which was entitled 'The High Price of Bullion a Proof of the Depreciation of Bank Notes,' speedily passed through four editions, and occasioned the publication of several replies. His next publication was entitled 'A Reply to Mr. Bosanquet's Practical Observations on the Report of the Bullion Committee;' and however much opinions may at that time have been divided upon the subject, it has long since been generally acknowledged that the victory rested with Mr. Ricardo. Although the peculiar interest which attended those discussions has long since passed away, Mr. Ricardo's pamphlet will be read with pleasure by all who delight in marking the ease with which a man of superior intellect can trace and exhibit the constant and active operation of general principles through all the intricacies of practical detail.'

In 1815 Mr. Ricardo published 'An Essay on the Influence of a Low Price of Corn on the Profits of Stock,' in which he combated the justice of restrictions on the importation of corn; but the essay is chiefly remarkable for the doctrine which it propounds concerning rent. [RENT.] The following year produced 'Proposals for an Economical and Secure Currency, with Observations on the Profits of the Bank of England.' The principal recommendation put forth in this pamphlet was, that the Bank of England should be obliged to exchange its notes for gold ingots of a certain fineness, and not below a certain weight, at prices diminishing from time to time, until the price should be brought down from its then market rate to the Mint price of *77s. 10½d.* per oz.

Mr. Ricardo's great work, that upon which his lasting fame as an economist must rest, 'On the Principles of Political Economy and Taxation,' was published in 1817, and was at once pronounced the most valuable contribution made to economical science since the days of Adam Smith.

In 1822 Mr. Ricardo again appeared as the author of a tract entitled 'On Protection to Agriculture,' in which he exposed certain fallacies and prejudices of the landed proprietors. The effects of legislative protection afforded to products of the soil upon wages, profits, public revenues, and non-agricultural branches of the national industry, are all discussed within the limits of eighty-seven pages, with a clearness and precision that may be said to exhaust the matter, and which prove the author to have been perfect master of the whole subject.

The only remaining work of Mr. Ricardo was found among his papers after his death, having been the latest matter of a public character that occupied his attention. This was his pamphlet in recommendation of a national bank, which was soon afterwards published by his family, in the exact state in which he left it probably only a few days before his death.

RICAUT, SIR PAUL. [RYCAUT.]

RICCI or RIZZI, SEBASTIANO, a painter, born at Cividal di Belluno, near Trevisano, in the Venetian state, in 1659 or 1660. He was placed early under the tuition of Frederigo Cervelli, at Venice. He accompanied his preceptor to Milan, and afterwards went to Bologna and Venice, to study the master-pieces of those two schools. He resided for some years at Florence and Rome, and ultimately made a tour of the whole of Italy, executing pictures at any price, wherever he obtained commissions, and leaving behind him a reputation almost universal. He afterwards travelled into Germany, England, and Flanders, completing his style from a careful study of the works of other artists, and especially improving in his mode of colouring. At Vienna he executed many works for the court, particularly some paintings on the walls of the imperial palace of Schönbrunn, and thence he returned to Florence, where he was employed to decorate several of the apartments in the palace of the grand-duke. Being invited to England by Queen Anne, he travelled through France, and at Paris was made a member of the Academy of Painting. The picture he executed for Chelsea Hospital, in the cupola of which he represented the Ascension, and the staircase of Montague House, now the British Museum, which he also decorated, prove him, says M. Périès, in the 'Biographie Universelle,' to be capable of great undertakings. He also painted the chapel at Bulstrode, for the duke of Portland, in the altar-piece of which, representing the Last Supper, he has introduced his own portrait in a modern habit. The hall and some of the ceilings of Burlington House, London, are also by him.

During his residence in England, which lasted ten years, he was most extensively employed, and his departure is said by Walpole to have been caused by disgust that Sir James Thornhill should have been selected to paint the dome of St. Paul's Cathedral. On quitting this country he returned to Venice, where he was constantly occupied on pictures for France, Spain, Portugal, and Sardinia. Ricci, in common with Luca Giordano, possessed the power of imitating with great exactness the style of the great masters who preceded him. Some of his pictures appear at first sight as if painted by Bassano or Paul Veronese, and one of his Madonnas, exhibited at Dresden, was for some time attributed to Coreggio. This facility of imitation is said, by the writer of the Life of Mignard, in 'L'Histoire des Premiers Peintres du Roi,' p. 152, to have deceived La Fosse as to the genuineness of one of his pictures in the style of Paul Veronese, a deception which called forth the sarcastic advice that Sebastian 'should thenceforth paint nothing but Paul Veroneses and no more Riccis.'

In his historical compositions Sebastiano is rather an imitator than a plagiarist, as in the Last Supper, in the church of Santa Giustina, at Padua, which greatly resembles the cupola of S. Giovanni at Parma, by Coreggio; and his S. Gregorio, at S. Alessandro in Bergamo, recals to mind the work of Guercino at Bologna. The same may be observed of his scripture histories, painted for S. Cosmo and S. Damiano, at Venice, which are preferred to any others that he executed for that place.

Sebastiano Ricci did not early acquire an extensive knowledge of design, but he cultivated it in after-life with extreme assiduity in several academies. The forms of his figures are composed with beauty, dignity, and grace, like those of Paul Veronese: his attitudes are natural and varied, and his composition is managed with truth and judgment. His colouring is distinguished by a beautiful azure, which remains in his fresco works, but in his pictures in oil, from the badness of the grounds, that as well as the other tints has faded.

Opinions vary much concerning the merit of this painter. M. Périès, following Lanzi, speaks of him in the manner above quoted, and Lanzi is in some respects far more eulogistic. Mr. Bryan observes, that though his design is not scrupulously correct, the forms of his figures are graceful, and his colouring, though sometimes feeble and cold, is often silvery and agreeable; and that, like most painters of decorations, he consulted his imagination more than nature, and frequently discovers the repetition and the weakness of a mannerist. A careful examination of the works he executed in this country will lead us to the conclusion at which an able writer in Rees's 'Cyclopædia' has arrived, that he was one of the few, comparatively speaking, who enjoy during their lives the utmost extent of their fame. In fact he was a machinist, one who, being conversant with the rules of art and skilful in the application of the means, dazzled where he could not instruct, and deluded by ingenuity without judgment and art without expression. In many of his works he was assisted by his nephew Marco Ricci, who resided with him in England.

Sebastiano died at Venice, on the 5th of May, 1734. Amongst the most noted of his productions may be enumerated the Massacre of the Innocents, at Venice; the Rape of the Sabines, at Rome; at Bergamo, Saint Gregory supplicating the Virgin in favour of the Souls in Purgatory, before referred to; at Vienna, several ceilings of the imperial palace, and an Assumption of the Virgin, at the church of St. Charles.

(Lanzi, *Stor. Pitt.*, iii. 225; *Biographie Universelle;* Walpole's *Anec. of Painting*, by Dallaway, iii. 281-2; Bryan's *Dict. of Painters.*)

RICCI. [JESUITS; PIUS VI.]

RICCIARELLI, DANIELE, generally called Daniele di Volterra, from the place of his nativity, was born in 1509. He appears to have first studied at Siena, under Antonio Razzi, called Il Sodoma, and afterwards under Baldassare Peruzzi. In the expectation of receiving greater encouragement at Rome, he repaired to that city, where he was first employed as an assistant to Pierino del Vaga in the Vatican, and in the Capella Massimi, in the church of the Trinità del Monte. He was chiefly indebted for the reputation which he subsequently acquired to the friendship and instruction of Michael Angelo, who gave him designs for the works which he executed in the Farnesina, and for others of his most celebrated performances. The principal monument of his fame was the series of frescoes in the church of La Trinità del Monte, representing the History of the Cross, on which he was employed seven years. Of these frescoes, the most remarkable was the famous Descent from the Cross, which was universally esteemed as one of the three finest pictures at Rome; the other two being the Transfiguration by Raphael, and the Communion of St. Jerome, by Domenichino. It has been affirmed that Michael Angelo not only assisted him by his advice, superintendance, and corrections, in the composition of this sublime performance, but that the figure of the Saviour and that of the Virgin Mary must have been the work of his master-hand. Unhappily we are unable to judge of the probability of this assertion; for the French, in their rapacious eagerness to possess so fine a work, barbarously attempted to detach the plaster from the wall, and broke it all to pieces. We have no means of judging of the grandeur of the composition but from the fine engraving of it by Dorigny. On the death of Pierino del Vaga, in 1547, he was recommended by Michael Angelo to Pope Paul III. as superintendant of the works in the Vatican, of which, and of his pension, he was deprived by Julius III.

Pope Paul IV., conceiving that the nudity of several figures in the Last Judgment was unsuitable to the sanctity of the place, had determined to destroy that great work; when Daniel undertook, and, according to a tradition which appears to be authentic, with Michael Angelo's own consent, to clothe the offensive figures. He was probably induced to do this, in order to save the picture from destruction, for which however he was ever afterwards called in ridicule Braghetone. He died at Rome, 1566, at the age of 57.

RICCIO'LI, GIOVANNI BATTISTA, was born at Ferrara in 1598, and became one of the principal cultivators of astronomy in Italy during the greater part of the seventeenth century. He entered into the Society of the Jesuits in 1614, and having diligently cultivated all the different branches of learning as they were taught in that age, he was chosen teacher of philosophy, rhetoric, poetry, and theology, in the colleges of their order at Parma and Bologna; but his inclination leading him to the study of geography and astronomy, he gave up his appointments, and applied himself wholly to the prosecution of those sciences.

His first published work was the 'Almagestum novum' (1653), which constitutes a treatise on astronomy. In it he mentions the origin of the science, and gives a list of those who had cultivated it: he also describes his method of measuring a degree of the earth's surface, and a pendulum of his own invention. He computes the obliquity of the ecliptic, the length of the tropical year, and the elements of the orbits of the sun, moon, and planets; he also treats of eclipses, and gives a long list of such as had been observed from the earliest time. The work contains a treatise on parallaxes, and some ideas of the writer concerning the body of the moon.

The learned world was then divided between the followers of Aristotle and the disciples of Copernicus in their opinions respecting the system of the universe. In the 'Almagestum,' Riccioli, having explained the ideas of the last-mentioned philosopher concerning the movement of the earth, offers a long series of objections to them, which, with a brief reply to each, may be seen in Delambre (*Histoire de l'Astron. Mod.*, tom. i., p. 672, &c.). He acknowledges however that the more we examine the hypothesis of the earth's several motions, the more we must admire the genius and sagacity of Copernicus, who had been able to explain so simply the phenomena of the heavens; and he expresses his regret that the fruits of a brilliant imagination should be set forth as realities. The admiration constantly expressed for Copernicus, and even the manner in which the objections to his theory are stated, have led to a belief that this learned Jesuit was a Copernican in his heart; and, from a passage in the work, it appears that the Aristotelians and theologians of that day, in their opposition, were more afraid of the consequences of making concessions in favour of a theory which seemed to them to be at variance with the letter of the Scriptures, than inimical to the theory itself.

The 'Almagestum' contains many passages which betray the prejudices of the age. As a reason for the necessity of reforming the calendar, Riccioli asserts that the blood of St. Januarius continued to liquefy on the 19th of September, though the time of the equinoxes had been anticipated by ten days: he finds several causes for the supposed eclipse of the sun which took place at the death of Christ, and he dwells at some length upon those which, it has been imagined, will immediately precede the end of the world.

In 1661 Riccioli published a work on geography and hydrography, in which is given an account of the operations which, in conjunction with P. Grimaldi, he had carried on in order to determine the length of a degree of the terrestrial meridian. For this purpose a base-line was measured near Bologna, and a triangulation was formed between that city and Modena; the stations appear however to have been improperly chosen, for the angles between them are often less than eight degrees, and only two were observed in each triangle. The instrument employed for obtaining the terrestrial angles was similar to the parallactic rulers of Ptolemy; and, in reducing the distances between the stations to one spherical surface, Riccioli assumed the refraction as constant, and equal to thirty minutes, as it had been determined by Tycho Brahé for celestial bodies in the horizon. The latitudes of the stations were determined by the sun and certain stars, their altitudes being observed with a quadrant whose radius was eight feet; but the declinations were taken from the catalogue of the astronomer just mentioned, and consequently were liable to errors amounting to one minute or more. It appears also that Riccioli entertained an opinion that the measures of the antients were nearly correct; hence, among his observations, he made choice of such as gave results which approached the nearest to those measures, and thus his determination of the length of a degree is found to have been very erroneous. The value expressed by 64,365 paces of Bologna (= 66,772 Eng. fath.), which he obtained by one of his methods, is considered by him as possessing an evidence in its favour which nothing can resist; it however differs far more from the truth than the determination of Snell, which had been made a few years previously in France; and in fact it is too great by above 6000 fathoms. The same work contains some remarks on the variation of the magnetic needle, observations on geographical longitudes and latitudes, and several problems relating to navigation.

Lastly, in 1665, Riccioli published his 'Astronomia Reformata,' a work in which he treats of refractions and parallaxes, and describes the instruments which he used to determine the places of the stars. He also gives a collection of the observations previously made on the planets, and he compares them with the astronomical tables which had then been published. The work concludes with several tables relating to chronology, geography, and astronomy, and with a catalogue of stars.

This writer, who is considered as having been less useful to mankind by his discoveries than by the care which he took to record those of his predecessors, died in 1671, at the age of seventy-three years.

RICE. In the article ORYZA [vol. xvii., p. 45] an account has been given of the botanical character and mode of cultivation of this useful grain. In order to remove the husk, which adheres very closely, without breaking the grain itself, several ingenious machines have been recently introduced, of some of which it is proposed to give a brief notice, referring for more detailed information to Hebert's 'Engineer's and Mechanic's Encyclopædia,' article 'Rice.'

The common mode of performing this operation in India and China, is by beating the grain in a kind of rude mortar of stone or earthenware, with a conical stone attached to a lever worked by the hand or foot. Sometimes several such levers are moved by arms projecting from the axis of a water-wheel. This process being uncertain and tedious, the preference has been given of late to a kind of mill, in which the stones are placed at such a distance asunder as to detach the shell without crushing the grain; the stones being enclosed in a case which prevents the dispersion of the rice by the rapid rotation of the machine. The rice is thrown out of the case by an opening in its side, and conducted over a sieve that separates the dust; after which it is made to fall in a gentle stream exposed to a current of air, produced by revolving fanners, and thereby separated from the husk. Such a sifting and winnowing apparatus is attached to each pair of stones, and, according to the work above referred to, one pair of stones will husk from eight to ten bushels an hour. After the removal of the husk, the grain is exposed to the action of a whitening machine, which removes the inner cuticle, or red skin, remaining on the surface of the grain. The machine used for this purpose very nearly resembles that described in vol. iii., p. 467, for the preparation of barley. This process is aided by the heat generated by the rapid motion of the grains, causing them to swell and split the red skin, which flies off in dust through perforations in the revolving case. With such accuracy are these processes performed, that it is said not more than five per cent. of the grain is broken in the operation.

The method of cleansing rice just described has been practised in Ceylon with British machinery; but other plans have been followed successfully in this country, where, owing to the difference between the duties on cleaned rice and *paddy*, or grain in the rough state, and the better preservation of the flavour of the rice when brought over in the husk, several large rice-cleaning establishments have been recently brought into operation. The process of Messrs. Lucas and Ewbank, for which patents were obtained in 1819 and 1827, consists in breaking the husk by millstones, and removing the red cuticle by beating or triturating in mortars; the latter operation being aided by mixing a quantity of the husks, well dried, with the grain, which obviates an inconvenience occasioned by the glutinous character of the red coating. The refuse matter and the broken grains are then separated by a peculiar kind of screen, and the rice is finally cleaned and polished by a machine with two concentric cylinders, the outer one remaining stationary, while the inner one, which is covered with sheepskin with the wool on, is caused to revolve with great velocity. The rice, being placed between the two cylinders, is thoroughly whitened by the friction of the wool.

In the apparatus patented by Mr. Shiel, the first operation is performed between one millstone and a piece of wood of precisely similar shape, and the subsequent removal of the dark pellicle is effected by rubbing between flat wooden surfaces covered with sheepskin, but with this distinction, that while Mr. Ewbank places the wool outwards, Mr. Shiel has it next the wood; its elasticity producing an effect very nearly resembling the rubbing of the grain between the palms of the hands.

Another ingenious contrivance, first used in the United States, consists of a long hollow cylinder of wood, with several bars projecting from its inner surface, and enclosing an axis on which are several other bars capable of revolving between those attached to the cylinder. By suitable toothed wheels the cylinder is made to revolve slowly in one direction, while the axis is turned with great rapidity in the contrary direction. The whole being placed in an inclined position, the paddy is allowed to enter the upper end of the cylinder by a hopper, and the mutual attrition of the grains, as they pass between the revolving bars, causes the separation of the husks, which are removed by a current of air as the grain falls into a bin under the lower extremity of the cylinder. The rice passes out of the cylinder by apertures capable of being enlarged or reduced at pleasure by means of sliding doors; and the action of the machine may be further regulated by varying the inclination of the cylinder, which may be placed vertically or horizontally, though an angle of about 45° is preferred.

Allusion has been made to the difference of the duty on cleaned rice and paddy, which, as may be seen from the following statement from Ellis's 'British Tariff,' 1839, discourages the importation of cleaned rice from foreign countries. The scale of duties is—

Rice, not being rough and in the husk .	15*s.* per cwt.
Rice in the husk, or paddy .	2*s.* 6*d.* per bushel.
Paddy imported from the West Coast of Africa . .	1*d.* per quarter.

If the produce of any British possessions, the duties are—

Rice, not being rough and in the husk .	1*s.* per cwt.
Rice in the husk, or paddy . .	1*d.* per quarter.

A drawback is allowed on the exportation of foreign rice that has been cleaned in this country; such drawback amounting to 10*s.* per cwt., which is equal to the duty paid on four bushels of paddy at 2*s.* 6*d.* per bushel.

RICE GLUE. [Cement, vol. vi., p. 412.

RICE PAPER, the name commonly, but erroneously, applied to a delicate vegetable film brought from China in small square pieces, tinged with various colours, and used as a substitute for drawing paper in the representation of richly coloured insects or flowers, and also in the manufacture of artificial flowers and other fancy articles.

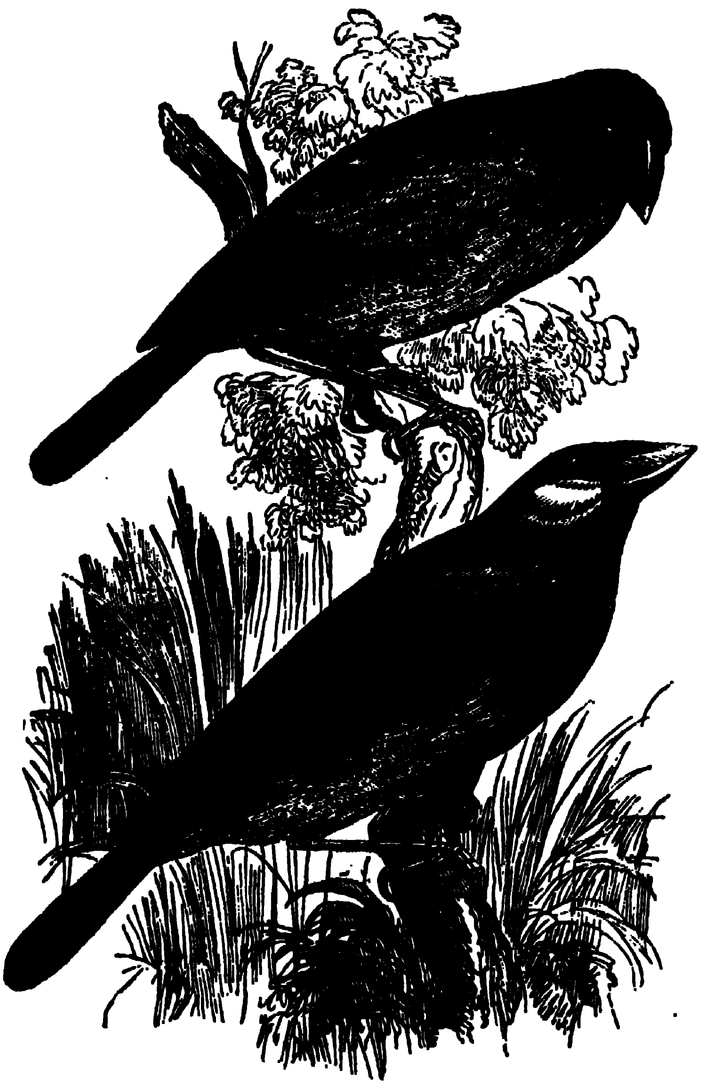
This substance, which is said to be a membrane of the bread-fruit tree (*artocarpus incisa*), is minutely described in a paper by Dr. Brewster, in the second volume of the 'Edinburgh Journal of Science,' from which it appears that though much resembling an artificial production, its vegetable organization is easily seen by the aid of a microscope, which shows 'that the rice-paper consists of long hexagonal cells, whose length is parallel to the surface of the film; that these cells are *filled with air* when the film is in its usual state; and that from this circumstance it derives that peculiar softness which renders it so well adapted for the purposes to which it is applied.'

RICE BIRD, one of the names of the *Paddy Bird*, *Puddee Bird*, or *Java Sparrow* (*Loxia oryzivora* of Linnæus).

This well-known bird, whose plumage is well described by Buffon as being so well arranged that no one feather passes another, whilst all appear to be covered with that kind of bloom which is visible on plums, giving them a beautiful tint, has the bill very much developed; indeed, with the exception of *Pyrenestes* and, perhaps, *Coccothraustes*, this finch is the most remarkable of the race for the size and power of that organ.

Description.—Bloomy lead-coloured, head and tail black, bill red, belly obscurely rosy, cheeks in the male snowy, legs flesh-coloured.

Locality, Habits, &c.—In Java, where it is called *Glate*, and the other parts of Asia where it is found, it has a very bad reputation on account of the ravages which it commits in the rice-fields with its powerful and sharp bill. In Sumatra the name of the bird is *Boorong Peepee*. It is often brought alive to this country, and confined in aviaries for the sake of its elegant shape and graceful colouring: its song, which is short and monotonous, does not much recommend it. This species must not be confounded with the *Rice Bird* of America, *Emberiza oryzivora*, Linn. [Bob-o-Link.]



Loxia oryzivora, Linn. Fringilla oryzivora of Swainson and authors. Upper figure, female; lower figure, male. (Swainson.)

RICH, CLAUDIUS JAMES, was born on the 28th of March, 1787, near Dijon in Burgundy, and, while yet an infant, was carried to Bristol, where he spent the earlier years of his life. He received a good education, and was early distinguished by his extraordinary powers in the acquisition of languages. At the age of eight or nine he happened to see some Arabic manuscripts in the library of a gentleman at Bristol, and was seized with a strong desire to acquire that language. This accidental circumstance led him to study the Oriental languages, in which he made such proficiency as to be able to read with considerable facility the Arabic, Hebrew, Syriac, Persian, and Turkish languages by the time he had attained his fifteenth year. His extraordinary acquirements in Oriental literature induced a friend to obtain for him, in 1803, the appointment to a cadetcy in the East India Company's service; and he was shortly after presented with a writership in the Bombay establishment by Mr. Parry, the chairman of the board of directors, in consequence of the strong recommendation of Sir Charles Wilkins. To enable him to perfect himself in the Arabic and Turkish languages, he was attached as secretary to Mr. Lock, who was at that time proceeding to Egypt as consul-general; and after the death of Mr. Lock, which happened before Mr. Rich joined him, he was allowed by the court of directors to prosecute such a course of travel as it was supposed might be most conducive to the object which he had in view. He accordingly went to Constantinople and Smyrna to study the Turkish language, and thence proceeded to Egypt to perfect himself in the Arabic and its various dialects. After leaving Egypt, he travelled over a great part of Palestine and Syria in the disguise of a Mameluke, and, confiding in his knowledge of the Turkish language and manners, ventured to visit the grand mosque at Damascus, while the great body of pilgrims was assembled at that city on their way to Mecca. From Syria he proceeded by Mardin and Bagdad to Bussora, whence he sailed for Bombay, which he reached in September, 1807.

On his arrival at Bombay, he resided at the house of Sir J. Mackintosh, to whom he had been introduced by the Rev. Robert Hall previous to his departure from England. In the following year he married the eldest daughter of Sir J. Mackintosh, and was shortly afterwards appointed the East India Company's resident at Bagdad, where he remained for about six years. During this time he prosecuted with the greatest diligence his favourite studies. He formed a rich collection of Oriental manuscripts, and also of medals and coins, and of the gems and engraved stones found at Babylon, Nineveh, Ctesiphon, and Bagdad. He made an excursion to Babylon in 1811 for the purpose of examining the ruins of that city, and afterwards published at Vienna, in the 'Mines de l'Orient,' a 'Memoir on the Ruins of Babylon,' which was subsequently reprinted in this country. In consequence of a paper published by Major Rennell, in the 'Archæologia,' containing 'Remarks on the Topography of Ancient Babylon, suggested by the recent Observations and Discoveries of C. J. Rich, Esq.,' in which he questioned some of his conclusions, Mr. Rich undertook another journey to Babylon, and in 1818 published, in London, a 'Second Memoir on Babylon,' in which he endeavoured to confirm the correctness of his first account; to this memoir he also added a valuable appendix on Babylonian antiques, illustrated by engravings, which represent fac-similes of many cuneiform inscriptions found upon bricks at Babylon. A second edition of these Memoirs, with the narrative of Mr. Rich's journey to Babylon in 1811, and to Persepolis in 1821, was published by his widow in 1839.

In 1813 Mr. Rich, being compelled by bad health to leave Bagdad for a time, travelled to Constantinople, and subsequently to Paris. He returned to Bagdad in 1815, where he resumed his former pursuits, and made large additions to his collection of MSS. and antiques. During this time he made the second excursion to Babylon already referred to; and in 1820 he made a tour into Koordistan. He went as far east as Sinna, and visited Sulimania, Mosul, and the ruins of Nineveh, and returned from Mosul to Bagdad down the Tigris. The journal which he kept on this occasion was published in 1836 by his widow, under the title of 'Narrative of a Residence in Koordistan,' and was accompanied by a valuable map of the country between Sinna, Arbil, and Mosul, which was drawn up from Mr. Rich's survey and astronomical observations. On his return to Bagdad, he intended to proceed to Bombay, where he had been appointed to an important office by the Hon. Mountstuart Elphinstone, who was then governor; but in consequence of an attack made upon the residency by the orders or with the connivance of the pasha, he retired to Bussora. While waiting for instructions from his own government, he employed his time in a tour to Shirauz, whence he visited the ruins of Persepolis and other remains of antiquity in that neighbourhood. While at Shirauz, he was attacked by the cholera morbus, and died of that disease on the 5th of October, 1821.

Mr. Rich's death was a great loss to his private friends and to Oriental literature. His disposition was amiable and kind, and his knowledge of many Oriental languages such as few Europeans have ever possessed. The Memoirs on Babylon were the only writings which he published in his lifetime, with the exception of a few articles in the 'Mines de l'Orient;' but he left behind him a considerable number of papers on various subjects. His collection of Oriental MSS., of coins and antiquities, was purchased by parliament for the British Museum. Mr. Rich, during his second residence at Bagdad and on his various excursions, was unwearied in his astronomical observations. He has left a very complete series of eclipses of Jupiter's satellites, and numerous altitudes of stars and lunar distances, most of which are computed, and the results in latitude and longitude deduced. It is probable that a re-calculation of the observations, *correcting the errors of the Ephemerides by contemporary observations at the standard observatories,* would improve the geography of the countries through which he travelled, though with a considerable amount of computation. Unfortunately his chronometer was so indifferent that the partial results cannot be combined. The emersions of Jupiter's first satellite observed at Bagdad, when so computed, throw the longitude a little to the east of Beauchamp's and Murphy's determinations. This seems to show that, from the clearness of the atmosphere or superior quickness of eye, Mr. Rich anticipated other observers, and saw the re-appearances earlier. His zeal as an observer may be estimated from the fact that when taking the sun at Bagdad the metal of his sextant was frequently too hot to be touched without pain; and after the most fatiguing marches, and while labouring under severe indisposition, he seized every favourable opportunity of fixing his position astronomically.

(*Brief Notice of the Life of Mr. Rich* prefixed to Mr. Rich's 'Narrative of a Residence in Koordistan.')

RICHARD I. II. OF NORMANDY. [NORMANDIE.]

RICHARD I., King of England, surnamed *Cœur de Lion*, was the third son of Henry II. and his queen Eleanor, and was born at Oxford, in the king's manor-house there, afterwards the monastery of the White Friars, in September, 1157. The history of the earlier part of the life of Richard has been already detailed. [HENRY II.] By the treaty of Montmirail, concluded 6th January, 1169, between Henry and Louis VII. of France, it was stipulated that the duchy of Aquitaine should be made over to Richard, who should do homage and fealty for it to Louis, and should espouse Adelais, or Alice, that king's youngest daughter; and in 1170, Henry, being taken ill at Domfront, in Maine, made a will, by which he confirmed this arrangement. In 1173, Richard, with his younger brother, Geoffrey, and their mother, joined their eldest brother, Henry, in his first rebellion against their father; on the submission of the rebels, in September, 1174, Richard received two castles in Poitou, with half the revenue of that earldom, and, along with Geoffrey, did homage and swore fealty to their father; nevertheless Richard continued from this time to hold the government of the whole of Aquitaine, and to be usually styled, as before, duke of Aquitaine, or duke of Poitou (which were considered as the same title), although it appears that Henry now looked upon the arrangements made at the treaty of Montmirail as annulled, and that dukedom to have actually reverted to himself. (Lyttleton's *Hist. of Henry II.*, vol. iii, p. 371.) In 1183 Richard refused, when commanded by his father, to do homage for Aquitaine to his elder brother Henry, on which Henry and Geoffrey invaded the duchy, and a new war ensued between them and their father assisted by Richard, which however was terminated by the death of the eldest of the three brothers, in June of that same year, when Richard became his father's heir apparent; but at an interview between King Henry and Philip Augustus of France, in November, 1188, Richard, apparently impelled by a suspicion that his father intended to leave his crown to his younger brother John, and also professing to resent Henry's conduct in withholding from him his affianced bride, the French king's sister, suddenly declared himself the liegeman of Philip for all his father's dominions in France; whence arose a new war, in which Philip and Richard speedily compelled Henry to yield to all their demands, and a treaty to that effect was about to be signed when Henry died, on the 6th of July, 1189. Richard was present at the burial of his father in the choir of the convent of Fontevraud.

Notwithstanding his apprehensions, real or affected, of his brother John, Richard made no particular haste to come over to England; but, contenting himself with ordering his mother Queen Eleanor to be liberated from confinement, and to be invested with the regency of that kingdom, he first proceeded to Rouen, where he was formally acknowledged as duke of Normandy, on the 20th of July, and it was the 13th of August before he arrived at Portsmouth (or, as others say, at Southampton). His coronation, from which the commencement of his reign is dated, took place in Westminster Abbey, on the 3rd of September. It was on occasion of that ceremony that a furious riot broke out against the Jews in London, which was in the course of the next six months renewed in most of the great towns throughout the kingdom. At York, in March, 1190, a body of five hundred Jews, with their wives and children, having taken refuge in the castle, found no other way of saving themselves from their assailants, except by first cutting the throats of the women and children and then stabbing one another.

A short time before his father's death, Richard and his then friend Philip Augustus, had, as it was expressed, taken the cross, that is to say, had publicly vowed to proceed to the Holy Land, to assist in recovering from the infidels the city and kingdom of Jerusalem, which had recently (A.D. 1187) fallen into the hands of the great Saladin. The mighty expedition in which all the principal nations of Western Christendom now joined for the accomplishment of this object is known by the name of the Third Crusade. Leaving the government of the kingdom during his absence in the hands of William Longchamp, bishop of Ely and chancellor, and Hugh Pudsey, bishop of Durham and justiciary, Richard took his departure from England on the 11th of December of this same year, 1189, and, proceeding to Normandy, united his forces with those of Philip Augustus in the plain of Vezelai, on the 1st of July, 1190. The two friends proceeded together at the head of an army of more than a hundred thousand men as far as Lyon, where they separated on the 31st; Philip taking the road to Genoa, Richard that to Marseille, where he was to meet his fleet. The fleet however not arriving so soon as was expected, Richard in his impatience hired thirty small vessels for the conveyance of himself and his suite, and, sailing for Naples, arrived there on the 28th of August. On the 8th of September he proceeded by sea to Salerno, where he remained till the 23rd, and then sailed for Messina, which port his fleet had reached about a week before, with the army, which it had taken on board at Marseille. The French king had also arrived at Messina a few days before his brother of England.

The two kings remained together at Messina till the end of March, 1191. During their stay Richard compelled Tancred, who had usurped the crown of Sicily, to relinquish the dower of his sister Joan, the widow of William, the late sovereign, and to pay him besides 40,000 ounces of gold. In return he betrothed his nephew Arthur, the son of his next brother, Geoffrey, to Tancred's infant daughter, and formed a league offensive and defensive with the Sicilian king—a connection which afterwards cost him dear, for it was the source of the enmity of the emperor Henry VI. who had married Constantia, the aunt of William, and claimed the throne of Sicily in right of his wife, who was undoubtedly the legitimate heiress of her deceased nephew. After the dispute with Tancred had been settled, the latent rivalry of Richard and Philip broke out in a quarrel about the Princess Adelais, whom her brother Philip insisted that Richard should espouse, in conformity with their betrothment, now that his father no longer lived to oppose their union. But if Richard had ever cared anything (which there is no reason to suppose he did) for the French princess, that attachment had now been obliterated by another which he had some years ago formed for Berengaria, the beautiful daughter of Sancho VI. (styled the Wise), king of Navarre; in fact, he had by this time sent his mother Eleanor to her father's court to solicit that lady in marriage, and, his proposals having been accepted, the two were now actually on their way to join him. In these circumstances, Philip found himself obliged to recede from his demand; and the matter was arranged by an agreement that Richard should pay a sum of ten thousand marks in five yearly instalments, and restore Adelais, with the places of strength that had been given along with her as her marriage portion, when he should have returned from Palestine. Adelais was in fact sent home some years after, and eventually she became the wife of William, earl of Ponthieu, by whom she had a daughter who was married to Ferdinand III., king of Castile, and was the mother of Eleanor, wife of our Edward I.

Richard, having sent his mother home to England, sailed from Messina on the 7th of April, at the head of a fleet of above two hundred ships, of which fifty-three were large vessels of the sort styled galleys; his sister the queen dowager of Sicily and the Princess Berengaria accompanying him. The king of France had set sail about a week before. Several months however elapsed before Richard reached the Holy Land, having been detained by an attack which he made upon the island of Cyprus, Isaac the king or emperor of which had ill used the crews of some of the English ships that had been driven upon his coasts in a storm. Richard took Limasol, the capital, by assault; and that blow was soon followed by the complete submission of Isaac and the surrender of the whole island. Isaac was put into confinement, and remained a captive till his death in 1195. Meanwhile the island of Cyprus was made over by Richard in 1192 to Guy of Lusignan, upon his resignation of the now merely titular royalty of Jerusalem to his rival Henry of Champagne; and Guy's posterity reigned in that island till the year 1458.

Having married Berengaria at Limasol, Richard set sail from Cyprus on the 4th of June (1191), with a fleet now described as consisting of thirteen large ships called busses, fifty galleys, and a hundred transports; and on the 10th he reached the camp of the Crusaders assembled before the fortress of Acre, the siege of which had already occupied them not much less than two years, and had cost the lives, it is said, of nearly two hundred thousand of the assailants. But the presence of the English king, although he was suffering from severe illness, and had to be carried to the trenches on a litter, immediately inspired so much new vigour into the operations of the Christian army, that on the 12th of July the place surrendered, and Saladin, who had been harassing the besiegers from the neighbouring mountains, withdrew in conformity with the terms of capitulation. This great event however was immediately followed by an open rupture between Richard and king Philip, whose rivalry had already exhibited itself in a variety of ways, and more particularly in the support given by the former to the claim of Guy of Lusignan, and by the latter to that of Conrad of Montferrat, to the vacant crown of Jerusalem. Philip in fact took his departure from Palestine on the last day of July, leaving only ten thousand men under the command of the duke of Burgundy.

Richard performed prodigies of valour in the Holy Land; but, although a signal defeat of Saladin, on the 7th of September, was followed by the capture of Jaffa and some other places of less importance, Jerusalem, all along professedly the main object of the crusade, so far from being taken, was not even attacked. Jaffa however, after it had again fallen into the hands of Saladin, was recovered by the impetuous valour of the English king. At last, on the 9th of October, 1192, Richard set sail from Acre in a single vessel, his fleet, having on board his wife, his sister, and the daughter of the captive king of Cyprus, having put to sea a few days before. The three ladies got safe to Sicily; but the first land the king made was the island of Corfu, which he took about a month to reach. He left Corfu about the middle of November, in three coasting-vessels, which he hired there, but, after being a few days at sea, he was compelled by a storm to land on the coast of Istria, at a spot between the towns of Aquileia and Venice. After narrowly escaping first from falling at Gorits into the hands of Maynard, a nephew of Conrad of Montferrat (to whose murder in Palestine Richard, upon very insufficient evidence, was suspected to be an accessory), and then at Freisach from Maynard's brother, Frederic of Betesow, he was taken on the 21st of December at Erperg, near Vienna, by Leopold, duke of Austria (a brother-in-law of Isaac of Cyprus), and was by him consigned to close confinement in the castle of Tyernsteign, under the care of his vassal, baron Haldmar. In the course of a few days however, by an arrangement between Leopold and the emperor Henry VI., the captive king was transferred to the custody of the latter, who shut him up in a castle in the Tyrol, where he was bound with chains and guarded by a band of men who surrounded him day and night with drawn swords. In this state he remained about three months. Meanwhile intelligence of his having fallen into the hands of the emperor had reached England, and excited the strongest sensation among all ranks of the people. A sketch of the course of events there during his absence has been given in the article on JOHN. It is sufficient to mention that a struggle for supremacy had for some time been carrying on with various success between the king's brother John and Longchamp, the chancellor, who had acquired the entire regency, and had also been appointed Papal legate for England and Scotland; and that this had issued, in October, 1191, in the deposition of Longchamp by a council of the nobility held in St. Paul's churchyard, London; after which he left the country, and although he soon ventured to return, ultimately deemed it most prudent to retire to Normandy. The supreme authority was thus left for a time in the hands of John, who, as soon as he learned the news of his brother's captivity, openly repaired to Paris, and did homage to the French king for the English dominions on the Continent. On his return to England, John raised an army to support his pretensions, and his confederate Philip took up arms in his behalf in France, and, entering Normandy, overran a great part of that duchy, although Rouen, the capital, was preserved principally by the exertions of the earl of Essex, lately one of Richard's companions in the Holy Land. In England also John met with a general opposition to his usurpation of the regal authority, which soon compelled him to conclude an armistice with a council of regency that had been appointed by the prelates and barons. This was the position of affairs when Longchamp, having discovered Richard's place of confinement, after much solicitation prevailed upon the emperor to allow the royal prisoner to be brought before the diet at Hagenau, where accordingly he made his appearance on the 13th of April, 1193, and defended himself with so much eloquence against the several charges made against him in regard to Tancred and the kingdom of Sicily, to his conquest of Cyprus, and to the murder of Conrad of Montferrat, that Henry found himself compelled by the general sentiment of the diet to order his chains to be immediately struck off, and to agree to enter upon negociations for his ransom. Longchamp was immediately dispatched to England with a letter to the council of regency, and the result was, that, notwithstanding the insidious efforts both of John and his friend Philip of France to prevent the conclusion of the treaty, Richard was at last liberated, on the 4th of February, 1194, after 70,000 marks had been actually paid to the emperor, and hostages given for the payment of 30,000 more. The English king had also engaged to release both Isaac of Cyprus and his daughter, and he had besides, at the persuasion, it is said, of his mother Eleanor, the more effectually to conciliate Henry, formally resigned his crown into the hands of the emperor, who immediately restored it to him to be held as a fief of the empire, and burthened with a yearly feudal payment to his superior lord of five thousand pounds. This strange transaction rests on the apparently satisfactory authority of the contemporary annalist Hoveden. Richard, descending the Rhine as far as Cologne, proceeded thence across the country to Antwerp, and, embarking there on board his own fleet, landed at Sandwich on the 13th of March.

Most of John's strongholds had been wrested from his hands before his brother's return, and now the rest immediately surrendered, and he himself fled the country, and with his principal adviser, Hugh, bishop of Coventry, having been charged with high treason, and not appearing to plead after forty days, was outlawed and divested of all his possessions.

Meanwhile it was thought necessary, perhaps on account of the formal resignation of his crown which he had been induced to make to the emperor, that Richard should be crowned again; and that ceremony was accordingly performed at Winchester, by Hubert, archbishop of Canterbury, on the 17th of April. Then, leaving Hubert guardian of England and grand-justiciary, on the 2nd of May following, having, with his characteristic activity, employed almost every moment since his arrival in raising an army and procuring funds for its maintenance by all sorts of exactions and the most unscrupulous use of every means in his power, he again set sail from Portsmouth, his whole soul bent on chastising the king of France. Owing to adverse winds, he was a fortnight in reaching Barfleur in Normandy, where, as soon as he landed, he was met by his brother John, who professed contrition and implored his pardon. On the intercession of his mother Eleanor, he consented to receive the submission of the repentant traitor, and to grant him his life, although he refused to restore him his lands. He now marched against Philip, and several engagements took place between them, in most of which the English king was successful. But the war, though it lasted for some years, was distinguished by few remarkable events. A truce for one year was agreed to on the 23rd of July; and, although hostilities were resumed some time before the expiration of that term, a peace was again concluded in the end of the following year, which lasted till the beginning of 1197.

All this time Hubert, assisted by Longchamp, who had been restored to his office of chancellor, is said to have presided over the government at home with great ability. Hubert had been educated under the famous Glanvil, and he seems, in the spirit of his master, to have exerted himself in re-establishing and maintaining the authority of the law, by which alone, even if he did no more, he must have materially contributed to the revival of industry. The large sums however which he was obliged to raise by taxation to meet the expenses of the war, in the exhausted state to which the country had been reduced, provoked much popular dissatisfaction; and the third year of the king's absence in particular was distinguished by the remarkable commotion excited by William Fitz-Osbert, styled Longbeard, a citizen of London, who is admitted to have possessed both eloquence and learning, and whose whole character and proceedings might not improbably, if he had had his own historian, have assumed a very different complexion from what has been given to them. Longbeard, who acquired the names of the Advocate and King of the Poor, is affirmed to have had above fifty thousand of the lower orders associated with him by oaths which bound them to follow whithersoever he led. When an attempt was made to apprehend him by two of the wealthier citizens, he drew his knife and stabbed one of them, named Geoffrey, to the heart, and then took refuge in the church of St. Mary-le-Bow in Cheapside, the tower of which he and his followers fortified, and held for three days, when they were at last, 7th of April, 1196, dislodged by fire being set to the building. Fitz-Osbert was first dragged at a horse's tail to the Tower, and then to the Elms in West Smithfield, where he was hanged, with nine of his followers. The people however long continued to regard him as a martyr. He appears to have been accustomed to appeal to the religious feelings of the populace in his attempts to rouse them against the government; even at that comparatively late day too he raised the old cry of Saxon against Norman, professing to wear his beard unshorn, it is said, out of affection for that custom of the more antient inhabitants of the land.

The war between Richard and Philip broke out again in 1197, and in the course of this campaign Richard had the gratification of capturing the bishop of Beauvais, a personage whom he had reason to regard as a main instigator of the severities and indignities which he had sustained at the hands of the emperor. The bishop was taken armed cap-à-pie and fighting, and when Pope Celestine recommended him to the clemency of Richard as his son, the English king sent his holiness the bishop's coat of mail, with the following verse of scripture attached to it:—'This have we found: know now whether it be thy son's coat or no.' This same year too finished the career of the emperor Henry, who in his last moments is said to have expressed the extremest remorse for the manner in which he had treated the great champion of the Cross. Richard's other enemy, Leopold, duke of Austria, had been killed by a fall from his horse two years before.

A truce, as usual, at the end of the year, again suspended hostilities for a space. The war was renewed on its termination, and in this campaign (of the year 1198) Richard gained one of his greatest victories, near Gisors, when Philip in his flight fell into the river Epte, and was nearly drowned. After this, by the intervention of the pope's legate, a truce was concluded between the two kings for five years, and they never met again in fight; although they probably would, notwithstanding the truce, if both had lived. But on the 26th of March in the following year, 1199, as Richard was engaged in reducing the castle of Chaluz, the stronghold of one of his Aquitanian vassals, Vidomar, viscount of Limoges, who it seems had refused to surrender a treasure found on his estate, to which the king laid claim in right of his feudal superiority, Cœur de Lion was struck in the left shoulder by an arrow, aimed, it is said, at the royal person, from the rampart of the castle, by a youth named Bertrand de Gurdun. The wound would not have been dangerous, but for the mismanagement of the surgeon in his attempts to extract the arrow-head, which had broken off in the flesh. As it was, Richard lived only till Tuesday, the 16th of April. The shot was a fatal one in every way; in the fury into which the wound of the king threw the besieging army, the castle was taken by storm, and all the persons found in it were immediately hanged, with the exception only of Gurdun. He was brought into the presence of his dying victim, when Richard, under the impulse of generosity or compunction, gave him his liberty, with a hundred shillings to take him home; but after the king's death he was flayed alive, by order of Marchadee, the leader of the Brabantine mercenaries serving in Richard's army.

Richard I. had no issue by his wife Berengaria, but he is said to have had one or two natural children. He was succeeded on the throne by his youngest brother, John, to the exclusion of Arthur of Bretagne, the legitimate heir, as being the son of his next brother, Geoffrey. [JOHN.]

The character of Richard is one of course not to be judged without reference to the general manners of the age in which he lived. He is charged by writers of his own or near his own time with crimes of all sorts, and it is probable enough that there was hardly an excess, either of violence or licentiousness, into which his impetuous temperament did not occasionally precipitate him; but, besides the sanction or indulgence for all this accorded by public opinion and the universal example, it is also to be said for Richard that, with all his passion and recklessness, he seems to have had nothing base or malignant in his composition; and that he was as capable of acts of extraordinary generosity and disinterestedness as of excesses of brutal fury or profligacy. Of the courage and strength of will proper to his race, he had his full share, with more than his share of their strength of thew and sinew; and his intellectual powers, both natural and acquired, were also of a high order. He was renowned in his own day, not only as beyond all dispute the stoutest and most gallant of living heroes, but as likewise occupying a place in the foremost rank of those who excelled in wit, in eloquence, and in song. Walpole indeed, in his 'Royal and Noble Authors,' tells us that Hoveden, the monkish annalist, 'says positively that Richard, to raise himself a name, bought and begged verses and flattering rhymes, and drew over singers and jesters from France to chant panegyrics on him about the streets, and it was everywhere said that the world contained nothing like him.' But in fact Hoveden says that this was done not by Richard, but by Longchamp, his chancellor. A few of Richard's poetical compositions have been preserved, and may be found in the following works:—'La Tour Ténébreuse,' 1705, which contains a love-song in Norman-French, and another chanson in mixed Romance and Provençal, said to be the joint composition of Richard and his favourite minstrel Blondel de Nesle, and to be that by which Blondel, according to the well-known story, now generally believed to be a fiction, discovered his master's prison; Walpole's 'Royal and Noble Authors,' which contains a poem of about forty lines in Provençal, from a MS. in the Laurentine Library at Florence, another version of which in Norman French (by some supposed to be the original), is given by Sismondi, 'Littérature du Midi de l'Europe,' vol. i., p. 149, and of which there are two English versions, one published in Burney's 'History of Music,' another by the late George *Ellis, in Park's edition of Walpole's work; Raynouard's 'Choix des Poésies des Troubadours,' vol. iv., containing the Provençal version of the same poem; and the 'Parnasse Occitanien,' Toulouse, 1819, in which another poem of Richard's is given. Richard is also a distinguished character in romance; on which subject it may be sufficient to refer the reader to Ellis's 'Specimens of Early English Romances,' vol. ii., p. 175-290 (edit. of 1811).*

The claim of Richard I. to the authorship of the antient maritime code called the Laws of Oleron, has been shown to be unfounded in another article [vol. xvi., p. 426]. Almost the only improvement in the laws or institutions of England which is attributed to him is some reform of the institution of justices itinerant introduced by his father; but it is not very clear in what this consisted; and, whatever it was, the merit of it appears to belong not to Richard, but to his viceroy Hubert. He is also said to have abolished some of the most cruel penalties of the forest laws, although he enforced that code generally with great exactness. What is called the time of legal memory, or the term requisite to establish immemorial usage, dates from the commencement of the reign of this king; though some recent acts of parliament have altered the law in this respect by shortening the time of prescription. [PRESCRIPTION.]

(The chief contemporary authorities for the history of the [illegible]n and exploits of Richard I. are, William of Newbridge [illegible]wburgh, Gervas of Canterbury, Roger de Hoveden, Ralph de Diceto, Benedictus Abbas, Josephus Iscarius, Richard of the Devizes, Greg. Alpharagius, Geoffrey de Vinesauf, and the Arabic historian Bohadin.)

RICHARD II. (surnamed of Bordeaux), King of England, was the second but only surviving son of Edward, styled the Black Prince, eldest son of King Edward III., by his wife Joanna of Kent [EDWARD III.], and was born at Bordeaux on the 3rd of April, 1366. He was consequently ten years and two months old when he lost his father, and not quite eleven years and three months when he succeeded to the throne on the death of his grandfather. His reign is reckoned to have commenced on the day following that event, the 22nd of June, 1377. His coronation did not take place till the 16th of July.

On the accession of a king who was thus still a minor, the powers of government were, by an assembly of the prelates and barons, vested in twelve counsellors, who were appointed to assist, in other words to direct and control, the chancellor and treasurer. From this council the king's three uncles, John of Gaunt, duke of Lancaster, Edmund of Langley, then earl of Cambridge, afterwards duke of York, and Thomas of Woodstock, then earl of Buckingham, afterwards duke of Gloucester, were all excluded; but this arrangement appears to have been collusive, and intended merely to lull the popular dislike and suspicion of Lancaster, in whose interest most of the counsellors are said to have been; and who, although he at first retired to his castle of Kenilworth, was the next year appointed to the command of a fleet fitted out to act against France. In the course of that year, 1378, great honour was obtained by John Philpot, a citizen of London, who, having equipped a small naval armament at his own expense, set sail with it against the Scottish privateer Mercer, who had recently carried off all the ships in the port of Scarborough, and succeeded in capturing him with all his prizes. During the next three years the war with France was prosecuted in Brittany under the conduct of the earl of Buckingham; but the death of Charles V., in September, 1380, having been speedily followed by a peace between the duke of Brittany and the new French regency, Buckingham, now finding an enemy in his former ally, was glad to return home with his army, in April, 1381.

Meanwhile in England the heavy pecuniary exactions called for by the war were hastening on a crisis which other causes had been long contributing to bring about. Three contending forces may be distinctly perceived at work in the ferment which now broke forth. First, there was the crown, or, rather, its natural ally the antient aristocracy, in whose hands the young king on the present occasion was, and of which he may be considered as the mere representative or instrument, striving to protect from encroachment the almost exclusive control of the national affairs which it had possessed at least from the æra of the Conquest. Secondly, there was the recently established House of Commons, the representative of the minor gentry and the middle classes, pressing forward to secure a share in the government, and, with the instinct of a growing power, *eagerly seizing hold of every opportunity of forwarding its object, its chief means being the right of taxation, of which it was already in the undisputed enjoyment, and which it had learned to apply with considerable skill as a screw for compressing the crown, and extorting from it new concessions and privileges.* It may be remarked that the present state of affairs, *with the king a boy and a cipher, and the* government in the hands of a regency, was peculiarly favourable for such attempts on the part of the House of Commons. Lastly, there was the great body of the population, forming the labouring class, of which by far the larger portion was yet engaged in agriculture, and in a state of villeinage or servitude, bound to the soil, and so confounded in some sort with the cattle and chattels of the landlord, counted, or at least treated, as *things* not as *persons*, at any rate in so far as all rights of a political character were concerned. But the example of what had recently taken place in other countries, in France and in Flanders, and the progress that the development of society had made among ourselves, had inspired even this the lowest class with a general desire of acquiring a new position in the commonwealth—of being raised from bondage to freedom and citizenship. Of course, both on the part of the House of Commons (or middle classes) and still more on that of the villeins, what was reasonable and right in this ambition may have been mixed with much that was ill-considered, extravagant, and impracticable; their efforts may have been, in some respects, ill-directed, both in regard to ends and means; but in the main, what took place must have happened if society was to advance at all, or even if it was to retain any principle of life. The explosion of these various elements was provoked by the state of pecuniary necessity to which the crown was reduced in the years 1379 and 1380. First, to induce the commons to grant the money that was wanted, it was found necessary, after a short struggle, to submit to their demands, of not only being allowed to inspect the accounts of the royal treasury, but even of appointing the king's ministers. Then, in December, 1380, the famous capitation tax was imposed, which gave rise to the rebellion of Wat Tyler in the summer of the year following. This formidable movement began at Fobbings, near Brentwood in Essex, on the 30th May, 1381, when the people rose against Thomas de Bampton, one of the commissioners who had been appointed to superintend the collection and enforce the payment of the tax. It thence spread over Essex, Kent, Suffolk, Norfolk and other counties along the eastern and southern coasts: the most noted among the popular leaders being two priests called Jack Straw and John Ball; Watt, the Tyler (or tiler) of Dartford, who headed the Kent men, and seems to have been by far the most determined and ferocious of the rebel captains; and two persons of the names of Lister and Westbroom, who were called kings of the commons in Norfolk and Suffolk. In the earlier part of the month of June, Tyler and his followers, having marched upon London, perpetrated a series of frightful devastations: they sacked the archbishop's palace at Lambeth, demolished the Marshalsea and King's Bench prisons, and the duke of Lancaster's palace of the Savoy, set loose the prisoners in Newgate and the Fleet, and destroyed the former building; set fire to the Temple, and to the Priory of the Knights Hospitallers at Clerkenwell; and massacred great numbers of the wealthier classes, among others the two first officers of the kingdom, the archbishop of Canterbury, who was chancellor, and Sir Robert Hales, the treasurer. At last, on the 15th, the career of the demagogue was suddenly terminated by the bold hand of Sir William Walworth, the lord mayor, who, when Tyler, coming forth from his men, rode up to the king stationed in front of the abbey of St. Bartholomew in West Smithfield, plunged a dagger into his throat, on which he was speedily dispatched by one or two other persons in the royal suite. Richard himself on this occasion, young as he was, showed great firmness and presence of mind. The insurgents, deprived of their leader, were easily induced to lay down their arms, and in a few weeks the rising of the commons was completely suppressed in all parts of the kingdom. The victory obtained by the king and the government was followed by the shedding of torrents of blood on the scaffold: it is said that the persons executed amounted in all to about 1500; Straw, Ball, and the other leaders being among the number. All the promises also that had been made to the congregated multitudes while they had still arms in their hands, were broken. The Essex men had only asked for the abolition of slavery, the fixing of a maximum for the rent of land, the universal liberty of buying and selling in fairs and markets, and a general pardon; and before they broke up and retired to their homes, they had actually received a written grant of these demands under the king's hand. Even Wat Tyler and the men of Kent, when they came to specify their terms, had insisted upon nothing more extravagant than that the forest law should be repealed, and all warrens, waters, parks, and woods thrown open, so that the killing of fish, fowl, and game of all kinds should be everywhere free to every man.

On the 14th of January, 1382, Richard was married to Anne of Bohemia, daughter of Charles IV., the late emperor of Germany. The next two years were filled up with a war against the French in Flanders, conducted by Henry Spenser, the young and fighting bishop of Norwich, who in the late commotions had distinguished himself by his decisive style of dealing with the rebels; first, as Froissart tells us, meeting them in the field, and then, when he had routed them, exchanging his sword and armour for a crucifix and sacerdotal robes, and, thus arrayed, confessing and absolving his prisoners as he hurried them to the gibbet; and who now went over to the Continent to assist the burghers of Ghent in their contest with the count of Flanders and the French king, and in support of the cause of Urban VI., in the general European war excited by the struggle between that pope and his rival Clement VII. The bishop in his first campaign defeated the count of Flanders, and took the town of Gravelines, but in the end he was obliged, in the spring of 1384, to make his way back with much precipitation to England, where he was arraigned by the parliament for the failure of the expedition, and his temporalities confiscated till the king should be repaid the money it had cost. In 1385 the war with France was transferred to Scotland; and in the summer of that year Richard, for the first time, appeared at the head of his army, which penetrated as far as Aberdeen, having on its way reduced Edinburgh, Dunfermline, Perth, and Dundee to ashes, without having however, during its whole progress, seen the face of the enemy. An expedition of John of Gaunt to Spain, to assert his claims to the throne of Castile and Leon, grounded on his marriage with Constance, the eldest daughter of the late king Peter the Cruel, after occupying him for about three years, terminated, in 1388, in the marriage of the duke's daughter Catherine to Henry prince of Asturias, the heir of the reigning Castilian king John I., an alliance which seated the descendants of the English duke for many generations upon the throne to which he aspired.

Meanwhile, during the absence of the duke, the ascendancy at home had been assumed by his younger brother Thomas, now duke of Gloucester; and in the latter part of the year 1387, an ill-conceived and worse-directed attempt of Richard to take the management of affairs into his own hands had resulted in the complete defeat of that design by Gloucester, the execution of Richard's two principal counsellors, the chief-justice Tresilian and Sir Nicholas Brember the lord mayor of London, and the expulsion of the archbishop of York, and of the royal minions De Vere, duke of Ireland, and De la Pole, earl of Suffolk, from the kingdom. The 'wonderful parliament,' as it was called, which met on the 3rd of February, 1388, after ratifying the proceedings of the victorious party, also sent Sir Simon Burley and three other knights to the scaffold, banished four more of the judges to Ireland, and in short completely put down the king's faction. On the 15th of August this year was fought the famous battle of Otterbourne, or Chevy Chase, in which the Scots lost their commander, Earl Douglas, but the English were finally driven from the field, after both their leader Lord Harry Percy (popularly designated Hotspur) and his brother Lord Ralph had fallen into the hands of the enemy.

Richard remained in the state of subjection to which he had been reduced by the 'wonderful parliament' for more than a year. At last, at a great council held in May, 1389, he unexpectedly intimated that, being now in his twenty-second year, he intended to take the management of affairs into his own hands; and the suddenness of the movement secured its success for the moment. Gloucester found it necessary to retire into the country. But, in fact, although no further attempt was made for the present formally to set him aside, his own indolence and indisposition to business very soon threw the government into the hands of his uncle Edmund, duke of York, and Lancaster's son, Henry of Bolingbroke, earl of Derby. John of Gaunt also now returned from the Continent, and had influence enough to force a seeming reconciliation between his royal nephew and Gloucester, and to bring back that duke and his party to court. After this some years passed without any changes or other events of importance. The country was still professedly at war both with France and Scotland; but after the suspension of hostilities had been long kept up by a succession of short amnesties, a truce for four years was concluded with both countries in 1394. His queen, who was called 'the good Queen Anne,' having died on Whitsunday in that year, Richard soon after solicited the hand of Isabella, the beautiful but still infant daughter of Charles VI.; after many delays, the treaty of marriage was finally arranged in October, 1396; and at the same time a further peace and alliance was concluded between the two countries for the space of twenty-eight years.

This French marriage is believed to have materially contributed to the domestic revolution that soon after followed. It was opposed before it was contracted, and reprobated afterwards, by Gloucester and the popular party; and on the other hand Richard is supposed to have counted upon the assistance of his father-in-law the French king, to enable him to rid himself of and avenge himself on his uncle. In the beginning of July, 1397, first the Earl of Warwick, and two days after the Earl of Arundel, the most intimate friends and confederates of Gloucester, were suddenly arrested by the orders of the king, who carried his project into effect with profound dissimulation and treachery; and a few days after Gloucester himself was seized in his castle of Plashy, in Essex, and immediately conducted a prisoner to Calais. A parliament was then called, which met on the 17th of September, and which, awed by the display of military force made by the king, and led by the example of the dukes of Lancaster and York and the Earl of Bolingbroke, all of whom Richard had previously seduced or forced into a public approval of the arrests, ratified all that had been done, and impeached the three peers, and also Arundel's brother, the archbishop of Canterbury, of high treason. The archbishop and Warwick were banished for life; Arundel was beheaded on Tower-hill; and when an order was sent to the governor of Calais Castle to bring up his prisoner Gloucester, the answer returned was that he had died, and few doubted that he had been made away with by the king's orders. It was immediately after this affair that Bolingbroke was raised to the dignity of duke of Hereford; Richard's half-brother, Sir John Holland (the son of his mother by her second husband), being at the same time made duke of Exeter. The subservient parliament, before it separated, devolved the whole power of government and legislation upon a commission of twelve peers and six commoners, all devoted to the king; and having also obtained from them the grant of a revenue for life, Richard might now be considered as almost an absolute sovereign.

This state of things however did not last long. Intoxicated by the success of his schemes, Richard now set no bounds to his exactions and extravagance; and, instead of being satisfied with the discomfiture and destruction of so many of the persons whose opposition he had had the most reason to fear, he seems to have been only thereby incited to the devising of means for ridding himself of others whom he still apprehended to be dangerous. Of those who had supported him in the prosecution of the late Duke of Gloucester and his friends, the two most powerful were the Duke of Hereford, and Mowbray, earl of Nottingham, now duke of Norfolk. While Hereford was riding from Windsor to London in December of this same year, he was overtaken by Norfolk, who, according to the account given by Hereford, more than hinted to him that he had reason to suspect the king was watching for an opportunity of destroying them both; his words were carried to Richard, probably by Bolingbroke himself; that nobleman, at any rate, when called upon in parliament to state what had passed, charged Mowbray with having given utterance to the treasonable expressions; and the result was, that after Mowbray had denied the charge, and the two had in compliance with the award of a court of chivalry, presented themselves on the 16th of September, 1398, at Coventry, to decide the matter by wager of battle, Richard suddenly interposed, forbade the combat to proceed, and pronounced sentence of banishment for ten years upon Hereford, and for life upon Norfolk. The issue of the duel, whatever it might have been, would probably have only delivered him from one of his enemies; this method removed both. But one of them doubtless resolved, while professing for the moment to submit to the sentence, that he would not be long in returning. Henry of Bolingbroke had been for some time sedulously and successfully attracting to himself the popular favour which his cousin Richard was fast losing or throwing away; and probably no other subject whom the king might have banished from England could have carried the affections and hopes of so many of his countrymen along with him. This he himself well knew. Accordingly, when in the beginning of February, 1399, about three months after his departure, his father died, and the estates which had now become his inheritance were seized by the crown, he did not hesitate as to the course he should take. Richard had set sail from Milford Haven on the 31st of May, at the head of a fleet of two hundred transports, to quell an outbreak of some of the native tribes of the south of Ireland: Bolingbroke, now calling himself duke of Lancaster, landed at Ravenspur in Yorkshire, on the 4th of July. The returned exile brought with him only forty followers; but by the time he had reached St. Alban's, on his unimpeded march to the capital, his army had increased to sixty thousand men. The Duke of York, in whose charge the government had been left, withdrew towards Bristol, to which place the Earl of Wiltshire, Bussy, Green, and others of the king's friends and servants had previously fled. Bolingbroke merely showed himself to the citizens of London, and, having received their plaudits and addresses of congratulation, set out for the west. York and he met in Berkeley Castle, where the regent after a short conference yielded to all his demands. They marched together to Bristol, where, having taken possession of the castle, Bolingbroke directed Wiltshire, Bussy, and Green to be executed, and then set out for Chester, and established himself in that city. Meanwhile Richard, long detained by tempestuous weather, had at last landed at Milford Haven on the 5th of August. He brought with him the greater part of the army he had carried over to Ireland two months before; but the men nearly all deserted the first night they found themselves again upon English ground. Richard then disguised himself as a Franciscan friar, and, accompanied by the Duke of Exeter and some others of his friends, fled to Conway, where it was understood that the Earl of Salisbury was in command of a numerous royalist force; but upon his arrival he found that that too had broken up some days before. On the 18th the Earl of Northumberland came to him from Bolingbroke, and induced him to accompany him to Flint Castle, where, on the following day, Bolingbroke presented himself at the head of about 80,000 men. The unhappy king proceeded to Chester in the train of his conqueror, and thence in a few days he was carried to London, where he was forthwith lodged in the Tower. Here, on the 29th of September, he consented to read a renunciation of the crown before a deputation of prelates, barons, knights, and lawyers, and to declare that, if he had the right of naming his successor, the man he would fix upon should be his cousin Lancaster. Such at least is the account inserted by Henry's order in the rolls of parliament. On the next day the two houses of parliament met together in Westminster Hall, and voted his deposition, immediately after which the Duke of Lancaster rose and claimed the crown, and was unanimously recognised as king. [HENRY IV.]

Richard did not long survive his dethronement. On the 23rd of October the house of peers, in a new parliament, on being consulted, by king Henry's order, as to what should be done with him, recommended that he should be closely confined in some castle, the knowledge of which should be kept secret from the people; and in conformity with their advice, he was a few days after privately conveyed away from London. All that is further known is, that in the following February rumours were everywhere spread that he was dead, and that in the beginning of March his body, or what was declared to be such, was brought with funeral pomp from Pontefract Castle to London, and there exhibited openly to the people. Afterwards it was reported, by some that he had starved himself to death, by others that he had been starved by his keepers, according to a third version of the story, that he had been violently made away with by Sir Piers Exton, assisted by seven other assassins. For many years also rumours continued to arise from time to time that he had made his escape, and was still alive in Scotland; and an attempt has lately been made to establish the probability of this strange story; but the supposed new evidence brought forward in support of it has been satisfactorily shown to be quite inconclusive.

Of the alterations made in the statute law during the reign of Richard II., the most important was the extension of the former Acts against provisors, or persons obtaining papal presentations to benefices before they were vacant, by a series of new Acts, and especially by the 16 Ric. II., c. 5, commonly called the Statute of Præmunire. [PRÆMUNIRE.]

In 1382 a statute was passed for apprehending and punishing the followers of the religious reformer Wycliffe, who are described as malevolent persons going about from county to county, and from town to town, in peculiar habits, with pretence of great sanctity, and without licence of the pope or the ordinary, preaching daily in the churches, churchyards, markets, fairs, and other open places where the people were assembled in greatest numbers, discourses full of heresies and notorious errors, to the great injury of the faith, and destruction of the laws and estate of holy church, &c. But this Act was repealed the same year, on the representation of the Commons that it had been passed without their assent. Just before its enactment twenty-four opinions, attributed to Wycliffe, had been condemned as heretical and dangerous by a synod of churchmen; the reformer appealed against the decree, but was ultimately induced to submit, and he remained in quiet at his rectory of Lutterworth, till his death, about two years after. His opinions however had already made great progress among the people; and the spirit which he had awakened by his preaching and writings continued to live and spread after his death, and no doubt materially contributed to prepare the way for the overthrow of the old religion, which was effected a hundred and fifty years later.

In the preceding year (1381), after the suppression of Tyler's rebellion, the offence of treason was extended to the act of beginning a riot, rout, or rumour, by the 5 Ric. II., st. i., c. 7; but this severe enactment was repealed in the reign of Edward VI. This is one of the antient statutes constituting the offence called *Scandalum Magnatum.* To the reign of Richard II. have been assigned the complete establishment of the court of the high admiral, and the enlargement of the jurisdiction of the Court of Chancery by the first issuing of writs of subpœna. [EQUITY; PLEADING IN EQUITY; SUBPŒNA, WRIT OF.] Finally, the right of impeachment and prosecution by the Commons in parliament, which had been first asserted in the latter years of Edward III., was finally established in this reign by the impeachment of the earl of Suffolk, the late chancellor, in 1386.

Richard II. had no issue by either of his wives (his second indeed was only a child of ten years of age at the time of his death); nor are any natural children assigned to him by the genealogists. Queen Isabel returned to France in 1401, and became the wife of her cousin Charles, duke of Orleans, after bearing a daughter to whom, she died, at the age of twenty, in 1409.

The transactions of this reign must be principally sought from public documents. Of the contemporary historical accounts the principal are, besides the graphic narrative of military transactions by Froissart, a work by a monk of Evesham, published by Hearne, in 1729; Knyghton's 'History of the Deposition of Richard II.,' in Twysden's 'Decem Scriptores;' and an alliterative poem in English on the deposition, and another, in Latin, by Richard Maydiston, a Carmelite friar, entitled 'De Concordia inter Ric. II. et Civitatem London.,' lately published together by the Camden Society. There is also in the Harleian Library (MS. 1319) a very curious history of the close of the reign, embracing both the deposition and the preceding expedition to Ireland, written in French verse by a person who professes to have belonged to the king's suite, and adorned with many illuminations of remarkable beauty and delicacy of execution. This interesting composition has been printed in the twentieth volume of the 'Archæologia,' with a translation and ample annotations by the Rev. J. Webb, and with engravings of all the drawings.

RICHARD III., king of England, was the youngest son of Richard, duke of York, whose descent is given in the article on EDWARD IV. Richard was born 2nd October, 1452, at Fotheringay Castle in Northamptonshire. On the defeat and death of the duke of York at Wakefield Green, 31st December, 1460, where the duke's second surviving son Edmund, styled earl of Rutland, was also killed, Richard and his elder brother George, afterwards duke of Clarence, were sent by their mother to Utrecht, where they remained under the protection of Philip, duke of Burgundy, till the crown of England was acquired (about two months after) by their eldest brother Edward. Soon after this event Richard was created duke of Gloucester, made a knight of the Garter, and appointed to the office of lord high admiral, though as yet only in his tenth year. In 1469 he was made one of the wardens of the Scottish marches: in 1470 he fled with the king, his brother, to Flanders on the sudden restoration of Henry VI. by the earl of Warwick: in 1471 he commanded the foreward of his brother's army at the battle of Barnet; and he also assisted in gaining for Edward his next and crowning victory of Tewksbury. He and his brother Clarence are asserted to have been the actual murderers of Henry's son Prince Edward, after the battle. [EDWARD IV.] To Gloucester also was popularly ascribed at the time the murder of Henry himself in the Tower a few weeks after. [HENRY VI.] The following year the Lady Anne Nevil, daughter of the earl of Warwick, and widow of Prince Edward, was prevailed upon to give him her hand.

In 1478 Gloucester took a foremost part in the attainder and destruction of his brother Clarence, whose removal placed him next after the king's issue in the order of succession to the throne. In 1482 he commanded an expedition against Scotland, in the course of which he took the town of Berwick and penetrated as far as Edinburgh. He had only recently returned from this expedition, and was still in command of his army on the borders, when the death of his brother took place, in the beginning of April, 1483.

On the receipt of this intelligence, Richard immediately prepared to set out for London, stopping however on his way at York, where he summoned the gentlemen of the county to swear allegiance to Edward V., taking the oath first himself. At Northampton he was met on the 29th of April by the duke of Buckingham, and it is believed that the measures, probably in part arranged previously by letter, were then finally concerted, by which Richard should be elevated to the throne. On the next day Edward's uncle, Earl Rivers, and his half brother, Lord Grey, who were at Stony Stratford with the king, were both arrested by Gloucester's orders; and possession was also taken of the royal person.

From his arrival in London to the disappearance of the young king and his brother towards the end of June [EDWARD V.], Gloucester, who now called himself Lord Protector, kept his residence at Crosby Place in the City, where he held frequent conferences with his confidants. On the 13th of June, Lord Hastings was arrested by his orders in the council-room at the Tower, and immediately led to execution; and two days after, the Lord Grey, Sir Thomas Vaughan, and Sir Richard Hawes underwent the same fate before the gate of Pontefract Castle. The public were informed by proclamation that these persons had been put to death as having, with the queen and her adherents, 'intended to murder and destroy the Protector and his cousin the duke of Buckingham, and the old royal blood of the realm.' Lord Stanley, the archbishop of York, and the bishop of Ely were also arrested.

On Sunday the 22nd of June, Dr. Shaw preached his famous sermon at Paul's Cross, in which he denounced both the present and the late king as bastards; and on the Tuesday following the duke of Buckingham harangued the citizens to the same effect from the hustings in Guildhall. The next day, Buckingham, accompanied by other lords, by Shaw the lord mayor (brother of the preacher), and by a number of other citizens, proceeded to Baynard's Castle, the residence of the duchess of York, where Richard then was, and in a long address offered him the crown and royal dignity in the name of the three estates of the land. Richard, after some affected hesitation, replied that he felt it to be his duty to obey the voice of his people, and that he would from that day take upon himself the royal estate of the two noble realms of England and France. On the following day, the 26th, he proceeded to Westminster Hall, and there formally declared himself king. The commencement of his reign is counted from that day, though he was not crowned till the 6th of July

Whether it was the fear inspired by the known determination and unscrupulousness of Richard's character, and the executions at London and Pontefract, that operated upon the public mind, or that any considerable part of the nation really preferred his claims to those of his nephew and the rest of his late brother's children, it must be admitted that his accession, so far from having been opposed in the first instance from any quarter, appears to have been everywhere hailed with all the evidences of popular approbation and rejoicing. Part of this favour, if it was not a mere show, he may have owed to the clemency and condescension which he affected as soon as he found himself fairly seated on the throne, and to the expectations of a mild or lax government which the very doubtfulness of his title would excite. But the story, in truth, has been so imperfectly transmitted to us, that it is difficult to weave any consistent or satisfactory theory out of the unconnected details that have been preserved. All we know is, that Richard, having immediately after his coronation set out with his queen on a tour through the northern parts of the kingdom, and having been everywhere received with apparently the most cordial gratulations by all classes, was suddenly surprised, while sojourning at York, by intelligence of a formidable confederacy which had been formed against him by the friends of his two nephews in the southern and south-western counties, with his own chief adviser the duke of Buckingham at its head. It appears that a rising would have taken place immediately throughout Kent, Essex, Sussex, Berkshire, Hampshire, Wiltshire, and Devonshire, had it not been prevented for the moment by its being ascertained that the two royal children were dead. This intelligence however only changed the plan of the conspirators. By the advice of the bishop of Ely, the crown was offered to Henry, earl of Richmond, on condition that he should marry Edward IV.'s daughter the Princess Elizabeth; and as soon as his acceptance of the proposal was received from beyond seas, his partizans called their followers to arms on the same day, the 18th of October, in all the parts of the country where they had influence. But this insurrection was quelled almost as soon as it broke out. Richmond, after having reached the coast of Devon, did not venture to disembark; Buckingham was deserted by a force of Welshmen that he had raised at Brecon, and, falling into the king's hands, had his head immediately struck off in the market-place of Salisbury; of his associates the most fortunate escaped beyond seas; and by the end of the month not an enemy of Richard's remained in arms in England.

A parliament was now summoned, which, having met on the 23rd of January, 1484, immediately passed an Act declaring Richard to be undoubted king of the realm of England 'as well by right of consanguinity and inheritance, as by lawful election, consecration, and coronation,' and bastardizing the issue of the late king Edward IV. by Elizabeth Rivers, whom it designated as the late wife of Sir John Gray, and denied to have any rightful title to the dignity of queen-dowager. This Act is known by the name of the *Titulus Regius*, and is the earliest of what are called the Private Acts, none of which are given in any of the printed collections of the statutes. The *Titulus Regius* however has been printed by Sir Robert Cotton, in his 'Abridgment of the Rolls of Parliament.' This Act was followed by others (also classed as private Acts), attainting and confiscating the property of all the principal persons engaged in the late revolt. But various Acts of public utility were also passed by this parliament; among others, one authorising every justice of the peace to admit a prisoner to bail, and directing that no officer should seize the goods of a prisoner till after his conviction; one regulating the impannelling of juries; one declaring and amending the law respecting the levying of fines; and several relating to commercial affairs, which, if they were not in all points grounded on the most enlightened principles, were at least in accordance with the opinions of the time, and must be regarded as evidences of a considerable interest taken by this parliament in the economical welfare of the country.

Soon after this however Richard deemed it expedient to adopt a new policy. The queen dowager, whom the parliament had just declared to have been only the late king's mistress, he now, in alarm at the projected alliance between her eldest daughter and the earl of Richmond, affected to court as his near and honoured kinswoman; he proposed marrying the princess Elizabeth to his own son Edward; and when that prince died (in April, 1484), and his queen, Anne, who had borne him no other children, soon after suddenly fell sick, he offered to marry Elizabeth himself. And strange as it appears, both mother and daughter went eagerly into this scheme; the princess in particular showed the utmost impatience for the marriage with her uncle, protesting that he was 'her joy and maker in this world, and that she was his in heart and thought,' and fretfully expressing her fears that queen Anne 'would never die.' And at this time she was living as a companion with the poor sick queen! But when Anne at last did die (on the 16th of March, 1485), not without suspicion of poison, his two confidants, Radcliffe and Catesby, succeeded in dissuading Richard from venturing upon this incestuous marriage, which they assured him would excite the popular indignation from one end of the kingdom to the other; and he then took great pains to proclaim that nothing of the kind had ever been contemplated.

He had the preceding year disembarrassed himself of one considerable source of annoyance and distraction by concluding a peace with Scotland for three years; and affiancing his niece, the lady Anne de la Pole, daughter of his sister the duchess of Suffolk, to James III.'s eldest son, the duke of Rothsay, afterwards James IV. (a transaction however which did not issue in an actual marriage). But at home the aspect of things was now becoming more unsatisfactory every hour. He durst not venture in the state of the public mind to call a parliament, and he found himself at once without money and nearly without an adherent upon whose fidelity he could depend. One after another the most eminent of those who had hitherto stood by him fled to France to join the earl of Richmond. At last, on the 7th of August, Henry landed at Milford Haven; and on the 21st of the same month the result of the battle of Bosworth deprived Richard at once of his crown and his life. [HENRY VII.; BOSWORTH.]

Richard left at least one natural son, known by the name of John of Gloucester, who, although yet a minor at his father's death, had been already appointed governor of Calais. There is also a romantic story told of a Richard Plantagenet, who died in the parish of Eastwell in Kent, in 1550, an old man of eighty-two, after a life spent as a working bricklayer, and who asserted that he was present at Bosworth Field, where Richard informed him he was his son; but this legend rests on the slightest authority. A natural daughter, named Katherine, is assigned to Richard, who was to have been married to the earl of Huntingdon, but who died in 1484, before she had reached the age agreed upon. The duchess of York, the mother of Edward IV., and Richard III., we may here notice, survived all those events, not dying till 1495.

Both the character of Richard III. and many of the events of his reign have been subjects of dispute among modern writers, some of whom have gone the length of attempting to make out that all the crimes imputed to him are the mere fabrications of his enemies. Much to this effect that Horace Walpole has advanced in his famous 'Historic Doubts,' had been anticipated by Sir George Buck, in his 'Life and Reign of Richard III.,' published so long ago as the middle of the seventeenth century. Buck's work however also contains a considerable quantity of matter not elsewhere preserved, at least in a printed form. The chief original historian of this reign is Sir Thomas More, in his unfinished tract, entitled 'A History of the Pitiful Life and Unfortunate Death of Edward V. and the Duke of York his brother; with the Troublesome and Tyrannical Government of the Usurpation of Richard III., and his miserable End.' There are the Latin annalists, John Rouss, or Rosse, and the continuator of the History of Croyland.

RICHARD PLANTAGENET, Earl of Cornwall, and titular King of the Romans and Emperor of Germany, was the second son of John, king of England, and was born January 5, 1208. He was created earl of Cornwall by his brother Henry III. in 1226; and he figures as one of the leading personages throughout that turbulent and distracted reign, showing generally much moderation and good sense in his endeavours to assuage the stormy contentions between the king and the barons, with whom he occasionally sided against the more outrageous excesses of the royal authority, although, as might be expected, without any participation in the design of abridging the antient prerogatives of the crown, and not without a natural regard in other respects to the interests created by his position. Although he showed some military talent on more than one occasion, his abilities on the whole seem to have been, like his politics, moderate, and of a middle character; he had no pretensions to a brilliant or commanding intellect, but he was at least as far removed from the weak-mindedness of the king his brother, generally evincing in his public conduct at least good sense and discretion, as well as a calm and conciliatory temper. It was a consequence of this moral and intellectual constitution however that, if he had no great vices, he should also be without great virtues; and that the reigning principle of his character should be a cold selfishness, which, though it might shrink from any course of violent aggression upon the rights of others, would yet be active in seeking all safe advantages; and, in that pursuit, would be in danger of sometimes tripping or overreaching itself, notwithstanding all its clear-sightedness and habitual caution. Richard, moreover, if he had no lofty or daring ambition, seems to have had a considerable share of vanity, which also would be apt to assist in betraying him in certain circumstances. If we take these considerations along with us, it will be easy to understand his career. After having first joined the barons who attempted to check the royal despotism, and afterwards more than once interposed successfully as a mediator between them and the king, we find him entirely separating himself from their latter and more decided proceedings; and, in the final struggle with De Montfort and his associates, which put in jeopardy even the possession of the crown by his family, resisting the insurgents as keenly as Prince Edward himself. The most remarkable incident however in Richard's history is his election as King of the Romans in 1256. This honour he is believed to have owed entirely to his great wealth, which d him to bribe several of the electors; but it is matter pute whether, after all, the majority of votes was given to him, or, at another election a few weeks after, competitor, Alphonso, king of Castile. Richard is only reckoned among the German emperors next after m, count of Holland, the successor of Conrad IV.; me historians distinguish the whole period from the of Conrad in 1254, to the accession of Rodolph I. in by the name of the Grand Interregnum. Richard wned at Aix-la-Chapelle, and occasionally exercised the imperial rights as could be exercised by a stroke of the pen or the expenditure of a little sealing-wax; but he never enjoyed any real authority in Germany, nor indeed did he show himself much in that country. He was taken prisoner by De Montfort, along with the king his brother, at the battle of Lewes, in May, 1264, and was confined in Kenilworth Castle for more than a year. He died in his house at Berkhampstead, on the 2nd of April, 1272.

Richard was thrice married: first, in 1230, to Isabel, daughter of the great earl of Pembroke, and widow of the earl of Gloucester, who died in 1240; secondly, in 1243, to Sanchia of Provence, a sister of his brother's wife, Queen Eleanor, who died in 1261; thirdly, in 1267, to a German lady, Beatrice, daughter of Theodoric de Falkmoute, and niece of Conrad, archbishop of Cologne, who survived him. Of five children which he had by his first wife, and two by his second, all died without issue. His second, and then eldest, son Henry, was assassinated in the church of St. Lawrence at Viterbo in Italy, by Simon and Guy, the two sons of De Montford, on the 3rd of March, 1271. The earls of Berkeley claim to be descended from a natural daughter of Richard, earl of Cornwall, Isabel, who married Maurice de Berkeley, the father of the first Baron Berkeley.

RICHARD DE BURY was born in 1287, upon the estate of his father, Sir Richard Angerville, or in Bury St. Edmunds, but it is probable that the predilection which occasioned his taking the name of that place arose from his having received the first rudiments of scholastic education there, from his uncle John de Willoughby, a clergyman. When sufficiently qualified, he was sent to Oxford, where he continued to study till he received the appointment of tutor to Prince Edward (afterwards Edward III.), with the office of receiver of his revenues in Wales. This situation enabled him to afford assistance to his royal pupil in the hour of adversity, for when Edward fled with his mother to Paris, and was distressed for want of money, De Bury secretly hastened to succour him, taking with him a large sum in gold, which he had collected while in office; but his flight being discovered, he was pursued by the king's lieutenant, with a band of twenty-four horsemen, even to Paris, where he narrowly escaped detection by being concealed during seven days in the belfry of the convent of Friars Minors. When Edward came to the throne, the fidelity of his tutor was rewarded by a rapid advancement to dignities both in church and state. He was first made cofferer to the king, then treasurer of the wardrobe and clerk of the privy seal; he also visited Rome twice, as legate to Pope John XXII., and on both occasions was treated with great honour and distinction, being made one of the pope's principal chaplains, and presented with a bull nominating him to the first see that should become vacant in England. His expenses the second of these journeys amounted to 500 marks. could not well be less, considering the splendour of etinue; for when he went into the presence of the and his cardinals, he was uniformly attended by 26 rks and 36 esquires, all attired in the most sumptuous anner. Whence the means were derived, may be seen in list of his appointments, which, besides the above-named, re, during the first six years of Edward's reign, two rectories, six prebendal stalls, the archdeaconries of Salisbury and Northampton, the canonry of Weston, and the deanery of Wells.

While at Paris, on his return from Rome, he received intelligence that the bishopric of Durham was vacant, and that the king had written to the pope requesting his presentation to that see. It happened that the right of election was vested in the prior and chapter of Durham, who, notwithstanding they had also a letter from the king, proceeded to elect Robert de Graystanes, a monk and subprior of Durham, who was confirmed and consecrated by the archbishop of York, as Bishop Godwin says, with more haste than good speed, for the temporalities were at the king's disposal, and he withheld them till he received the pope's answer, which happened to be dated one day prior to the election of Graystanes, and confirmatory of the appointment of De Bury. Upon this Graystanes was deposed, and De Bury consecrated by the archbishop of Canterbury, on the 19th of December, 1333.

The ready submission to this infringement of the right of appointment by all the parties concerned, has been severely remarked upon by those who were not interested in it. In 1334 De Bury was made chancellor and high treasurer of England. Within the three following years he was thrice at Paris as ambassador to the king of France, upon the subject of Edward's claim to the crown of that kingdom, and in the same character he visited Antwerp and Brabant. He had been installed at Durham by proxy, and had once visited the see, but in 1337 he did homage to the archbishop of York. It does not appear when he resigned any of his political appointments, but he probably did not pass much of his time in his diocese till after 1338. When he had leisure, we find him deeply involved in pursuits far more congenial to his taste than politics. Accident made him a statesman, but he was a scholar from habit and natural inclination. In early youth he delighted in the society of learned men, but of books 'in which wisdom is contained' he was an enthusiastic lover and the most distinguished collector of his age. Fortunately for him the king encouraged this disposition, and allowed him to use the influence of office in the promotion of his views. He purchased freely in his travels and at home, where he made himself acquainted with every collection, public and private. Moreover, he says, when it became commonly reported that books, especially old ones, were more precious in his estimation than money, or such new-year's gifts and other presents as it was customary to make in his time, they flowed in abundantly from all quarters. His researches saved many books that would have perished from neglect; and those he caused to be repaired. Such as he could borrow, if they were not for sale, he caused to be copied, for which purpose he had an establishment of book-binders, stationers, and illuminators in his palace. It is said that he finally became possessed of more books than all the other bishops of England put together; but it is a just tribute to his memory to state that his exertions were intended for the public good, and not merely for the gratification of a taste by no means unbecoming, though it was remarked upon as almost peculiar to himself at the time. In a sketch of his will, made shortly before his death, he says he bequeaths all his books to a company of scholars residing in a hall at Oxford, as a perpetual alms-deed for his own soul and for the souls of his parents, and of King Edward and his consort. The books went to Oxford, but Bishop Godwin could not find that he made a foundation there, as it has been stated. The hall in which they were deposited was on the site upon which his successor Hatfield founded Durham (now Trinity) College.

De Bury was not only a very learned man, but a liberal patron of learning, and it is evident that what he calls his extatic love for books was identified with the love of literature, and an ardent desire for promoting the same feeling in others, whom he amply supplied with the means of acquiring knowledge. He regretted the general ignorance of the Greek and Hebrew languages, and took care to provide grammars of both. In searching for elementary books generally, even the village schools did not escape his scrutiny. There is no doubt that De Bury was acquainted with Greek, and he probably learned it at Oxford. Grosseteste, who died in 1258, learned Greek and Hebrew at Oxford, from which it appears that these languages were taught there before De Bury's time. That Greek was taught in England still earlier than Grosseteste's time is also certain. [ROBERT OF LINCOLN.]

The best account of his researches and of his life will be found in the 'Philobiblon,' a small treatise written for the purpose of explaining his objects, of giving directions about books generally, and particularly about his own collections, and even of justifying his conduct, for there were many who derided his pursuits, and thought them altogether extravagant. This tract was first printed at Cologne, in 1473; afterwards at Spires, in 1483; Paris, 1500; Oxford, 1599, and in the collections of Goldast and Schmid: a limited impression of an English translation was published in London, 1832. There is no other known work by him extant, though one is mentioned under the title of 'Orationes ad Principes,' and some letters are spoken of. He [illegible] had an extensive correspondence with the most distinguished literary men of his time. Petrarch, with whom he conversed, calls him a man of an ardent and enthusiastic turn. He bears an excellent character generally; his wealth was freely bestowed upon the deserving but needy scholar, and he was equally munificent in distributing alms to the poor. His book evinces a benevolent disposition, though we must except against his refusing the use of books to the laity, but his precautions against the abuse of them are worthy of all commendation. He died at Aukland, on the 14th of April, 1345, aged fifty-eight, and was buried with due honours in the southern angle of the cathedral of Durham.

RICHARD OF CIRENCESTER, or *Ricardus Corinensis* (sometimes called the Monk of Westminster), a monkish historian of the fourteenth century, so named from his being a native of Cirencester in Gloucestershire. No traces of his family or connections have been discovered, nor has the exact time of his birth been ascertained, although the superior education which he received has led to the supposition that his family was of the higher ranks. He entered the Benedictine monastery of St. Peter, Westminster, in 1350: his name occurs in various documents in 1387, 1397, 1399, and he is registered in one of the chamberlain's lists preserved among the abbey records, by the name of Circestre. He composed several elaborate works on Saxon and British history, and to increase his knowledge he visited most of the libraries in this country for reference to original manuscripts. He obtained a licence to visit Rome from his abbot in 1391, the original of which is still in existence. It is supposed that he undertook this journey between 1391 and 1397, for he appears to have been confined in the abbey infirmary in 1401, and to have died in that or the following year. His work entitled 'Historia ab Hengista ad ann. 1348,' is in two parts. The first part is from the arrival of the Saxons to the death of Harold. His theological works were, 'Tractatus super Symbolum Majus et Minus,' and 'Liber de Officiis Ecclesiasticis.' But he is chiefly known from his celebrated treatise entitled 'De Situ Britanniæ,' which lay hid in manuscript till 1747, when it was first discovered by Charles Julius Bertram, professor of the English language at the Royal Marine Academy at Copenhagen, who sent a transcript of the whole to Dr. Stukeley, with a copy of the MS. In 1757 Dr. Stukeley published an analysis of the work, with the 'Itinerary;' and other particulars may be seen in the second volume of Dr. Stukeley's 'Itinerarium Curiosum,' and in Whitaker's 'Manchester.' In the same year the original was published at Copenhagen by Professor Bertram, with the remains of Gildas and Nennius, under the title 'Britannicarum Gentium Historiæ Antiquæ scriptores tres Ricardus Corinensis, Gildas Badonicus, Nennius Banchorensis,' &c., 8vo., but this work became scarce. In 1809 an edition was published in London, entitled 'The Description of Britain, translated from Ricardus of Cirencester, with the original treatise De Situ Britanniæ,' with the map and a fac-simile of the manuscript, as well as a commentary on the Itinerary. The discovery of this treatise may be regarded as an æra in the study of British and Roman-British antiquities. The Itinerary contains eighteen journeys which Richard says he compiled from certain fragments written by a Roman general and from Ptolemy and other authors; he mentions a hundred and seventy-six stations (while Antoninus has only 113), some of them a considerable distance north of the wall of Severus, besides which there are numerous chasms which show that many names have been lost or obliterated. The credit and fidelity of Richard have been attacked, but with little success; for wherever the subject has admitted of local investigation, the result has added to the estimation of his authenticity. Gibbon says of him that 'he shows a genuine knowledge of antiquity very extraordinary for a monk of the fourteenth century.' He is frequently quoted by his Latin name Ric. Corin., *i.e.* Ricardus Corinensis.

RICHA'RDIA, the name of a genus of plants belonging to the natural order Araceæ, of which only one species is known, the *R. Æthiopica.* It was introduced into this country from the Cape, under the name of *Calla Æthiopica*, in 1731. It is also found wild at St. Helena. It is one of the most beautiful of Aroideous plants. Its large spathe is pure white, surrounding a spadix which is coloured deeply yellow by its antheriferous flowers. Richardia is a hardy plant, bearing well our mildest winters, and growing in great vigour and beauty in the ordinary apartments of a house. It may be made to blossom all the year round.

RICHARDSON, JONATHAN, a portrait-painter, was born about the year 1665. His father dying when he was only five years old, his mother's second husband articled him to a scrivener; but as his master died in the sixth year of his clerkship, he followed the bent of his inclination, and at the age of twenty became a pupil of John Riley. After leaving this instructor, with whom he studied four years, and whose niece he married, Richardson commenced the practice of portrait-painting, in which, even during the lives of Kneller and Dahl, he obtained great employment, and upon their decease he was considered as the head of his profession in England. The profits of his business enabled him to retire from practice many years before his death, which happened suddenly at his house in Queen-square, Westminster, on the 28th of May, 1745. Hudson, the preceptor of Sir Joshua Reynolds, was his pupil and son-in-law. As an artist, Richardson was one of the best painters of a head that this country had at that time produced, but there his merit ended. He had strength, roundness, and boldness in his colouring; but his attitudes, draperies, and backgrounds are insipid and unmeaning, and the disposition of his subjects shows that he was wholly devoid of imagination. There are a few etchings of portraits by his hand, among which are his own, prefixed to his work on Criticism; John Milton; Alexander Pope, two plates, one of them a profile; and Dr. Mead.

It is however as a writer on art that the fame of Richardson must depend. In 1719 he published two discourses, entitled 'An Essay on the whole Art of Criticism as it relates to Painting, and an Argument in behalf of the Science of a Connoisseur,' in one volume, octavo. This work contains the rules of painting and of pictorial criticism laid down with judgment and precision, and expressed in language both forcible and just. It is truly observed of the above essay by a writer in the 'Pictorial History of England,' vol. iv., p. 733, that it 'should be in the hands of every one who seeks for knowledge of sound principles, and would learn to appreciate the divine excellences of Raffaelle.' In it he makes many admirable remarks upon the various styles of this exquisite painter: his Perugino, his Florentine, and his Roman manner. He also refers with pride to our national treasures at Hampton Court, the Cartoons of Raffaello, and pronounces as to them and the Transfiguration, that as they were the last, so they are the best productions of his hand. The Essay and the Argument with 'The Theory of Painting,' by Richardson, were published together in an octavo volume by his son in 1773. This latter composition also contains an able criticism on the style of Raffaello, acute observations on the Cartoons, and some valuable notices of the paintings by him in the Vatican. In 1722, in conjunction with his son, he published 'An Account of some of the Statues, Bas-Relie Drawings, and Pictures in Italy, &c., with Remarks by Mr. Richardson, sen. and jun.;' and in 1734 they published together 'Explanatory Notes and Remarks on Milton's Paradise Lost, with a Life of the Author, and a Discourse on the Poem.' In 1776 the son published a volume of poems by his father, but they possess very little literary merit. (Walpole's *Anecdotes of Painting*, by Dallaway, iv., 23-29; Bryan's *Dictionary*.)

END OF VOLUME THE NINETEENTH.

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